Surgical Management of Anisometropic Amblyopia in Adults

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Abstract: Anisometropic amblyopia is characterized by unequal refractive error between the two eyes. This study was conducted from May 1 to November 31, 2016, at Al-Azhar University, Egypt, to determine if anisometropic amblyopia detected in adults can be improved. A total of 10 adults, all are females (100.0%), were surgicaly managed for anisometropic amblyopia. All the patients were managed by clear lens extraction. Success was defined as improvement of BCVA On the amblyopic eye compared to pre-operative at the end of the study. BCVA improved to 0.25 in 6 (60%) patients and 0.33 in 4 (40%) patients.
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1. Introduction

Amblyopia also called lazy eye is a disorder of sight. It results in decreased vision in an eye that otherwise appears normal. Whenever the brain does not receive visual signals from an eye for a long period of time, there is a risk of amblyopia. It also can occur when the brain "turns off" the visual processing of one eye to prevent double-vision, for example in strabismus (crossed eyes). The cause of amblyopia is within the brain. ***(Levi D, 2013).***

Amblyopia can be caused by deprivation of vision early in life by vision-obstruction disorders such as congenital cataract, strabismus (misaligned eyes), anisometropia (different degree of myopia or hypermetropia in each eye), and significant amount of astigmatism in one or both eyes. **(*Wright KW, et al 1999).***

Refractive amblyopia may result from anisometropia (unequal refractive error between the two eyes) ***(David R, et al 2001).***

Anisometropia was defined as a difference of 1.00 diopter (D) in the myopic, hyperopic and astigmatic refractive error between the patient two eyes. Patients were classified into these three groups (myopic, hyperopic and astigmatic refractive error) or were classified in a mixed group if more than one type of errors was present. ***(Chen PL, et al 2007).***

Patients with anisometropia are treated conventionally with spectacles and/or contact lenses. However, spectacle correction may lead to anisokonia, and patients may become contact lens intolerant, which leads some ophthalmologists to suggest refractive surgery in these cases. Several reports have suggested that refractive surgery may be beneficial compared with traditional intervention for amblyopia therapy. By reducing anisometropia, refractive surgery has been reported to improve spectacle tolerance, facilitate amblyopia therapy, and enhance binocular vision. Treatment with refractive surgery, which includes photorefractive keratectomy (PRK), laser in situ keratomileusis (LASIK), laser-assisted subepithelial keratectomy (LASEK), phakic intra ocular lens (PIOLs) and clear lens extraction (CLE). ***(Wu C, et al 2006).***

2. Methods and Results

Ten adult patients, defined as age > 39 years, 10 (100%) females were recruited between May 1 to November 31, 2016, at Al-Azhar University, Egypt. The inclusion criterion was anisometropia as the only cause of decreased vision in the amblyopic eye. Patients with decreased visual acuity 2-line difference between the two eyes and more than 10 D of myopia. The patients signed consent for intervention including, advantages and disadvantages, risks of possible complications and periodical follow up for evaluation of vision after 1week, 1, 2, and 3 months of surgery. after the surgery. After detailed history, the patients underwent a complete ocular examination. Therefore, Visual acuity (UCVA), BCVA, Refraction, Slit-lamp examination of eye, Fundus examination. All cases of anisometropic amblyopia will treated by CLE.

The age, sex, presenting best corrected visual acuity (BCVA), amblyopic eye, refractive error in the amblyopic eye and the final best corrected visual acuity (BCVA) and refractive error were noted down (Table-1).

3. Results

On start of study

Mean (UCVA) on amblyopic eye 0.01 ± SD 0.01 ranged from (0.03–0.01), mean spherical refraction on amblyopic eye -13.75 ± SD 1.66 ranged from (-16 – -11), mean cylindrical refraction on amblyopic eye -

1.00 ± SD 0.47 ranged from (-2 – -0.5), mean spherical equivalent -14.18 ± SD 1.74 ranged from (-16.5 – -11.5), mean BCVA on amblyopic eye 0.09 ± SD 0.02 ranged from (0.06 – 0.1), mean axial length 29.09 ± SD 0.58 ranged from (28.1–-30.1) mm.

Table 1: The age, sex, presenting best corrected visual acuity (BCVA), amblyopic eye, refractive error in the amblyopic eye and the final best corrected visual acuity(BCVA) and refractive error

Case	age	Sex	Amblyopic eye	Pre-operative BCVA	Pre-operative spherical refraction	3monthes Post-operative BCVA	3monthes Post-operative spherical refraction
1	39	female	right	0.1	-12.50	0.33	-2
2	44	female	left	0.06	-13.25	0.25	-1
3	50	female	right	0.1	-15.50	0.33	-1.25
4	48	female	left	0.1	-13.75	0.33	-1.75
5	39	female	left	0.08	-16.00	0.25	-1
6	55	female	left	0.06	-11.00	0.25	-1.25
7	54	female	right	0.1	-12.00	0.25	-1.75
8	50	female	right	0.1	-14.00	0.25	-2.5
9	44	female	left	0.1	-13.25	0.33	-1
10	45	female	right	0.06	-15.50	0.25	-2

One week after surgery

Mean (UCVA) on amblyopic eye 0.09 ± SD 0.02 ranged from (0.06 – 0.1), mean spherical refraction on amblyopic eye -1.10 ± SD 0.38 ranged from (-1.75– -0.5), mean cylindrical refraction on amblyopic eye -1.42 ± SD 0.74 ranged from (-2.75– -0.75), mean BCVA on amblyopic eye 0.12 ± SD 0.05 ranged from (0.06 – 0.25).

One month after surgery

Mean (UCVA) on amblyopic eye 0.16 ± SD 0.05 ranged from (0.06 – 0.25), mean spherical refraction on amblyopic eye -1.28 ± SD 0.41 ranged from (-1.75– -0.5), mean cylindrical refraction on amblyopic eye -1.57 ± SD 0.6 ranged from (-2.75– -0.5), mean BCVA on amblyopic eye 0.20 ± SD 0.07 ranged from (0.1 – 0.33).

Two month after surgery

Mean (UCVA) on amblyopic eye 0.17 ± SD 0.04 ranged from (0.1 – 0.25), mean spherical refraction on amblyopic eye -1.45 ± SD 0.46ranged from (-2– -0.75), mean cylindrical refraction on amblyopic eye -1.08 ± SD 0.82 ranged from (-2.75 – -0.25), mean BCVA on amblyopic eye 0.26 ± SD 0.07 ranged from (0.1 – 0.33).

After 3 month of surgery

Mean (UCVA) on amblyopic eye 0.20 ± SD 0.07 ranged from (0.1 – 0.33), mean spherical refraction on amblyopic eye -1.55 ± SD 0.52 ranged from (-2.5– -1), mean cylindrical refraction on amblyopic eye -0.73 ± SD 0.42 ranged from (-1.75 – -0.25), mean Spherical equivalent -1.83 ± SD 0.43 ranged from (-2.75 – -0.75), mean BCVA on amblyopic eye 0.28 ± SD 0.04 ranged from (0.25 – 0.33).

4. Discussion

Small degrees of anisometropia can often be satisfactorily corrected with contact lenses or spectacles. However, at higher degrees, these conservative measures can become intolerable due to optical aberrations, glare, reduced visual field, or cosmetic/convenience considerations. In these circumstances patients may do surgical correction of their condition. ***(Pan CW, et al 2015).***

The two intraocular refractive surgeries are CLE and PIOL placement. CLE allows implantation of a divergent IOL into the lens capsule as one would generally do after cataract surgery, but eliminates the ability for natural accommodation and thus induces presbyopia. This is a major concern considering the young age of many patients seeking refractive surgery. It also carries a higher risk of retinal detachment (2-8%) due to removal of the crystalline lens and the potential for anterior displacement of vitreous, which is of particular concern given that highly myopic eyes are already at increased risk for retinal detachment. ***(Alió JL, et al 2014).***

Many original studies and reviews have been made to assess the results of such procedures and risk of intraoperative and postoperative complications.

1. Spherical equivalent

In ***Emarah AM, 2010*** was -17.54 D, in ***Horgan, 2005*** was -13.7 D, in ***Arne JL 2004*** was -16.7 D, in ***Fernandez-Vega, 2003*** was -17.84 D, in ***Guell,2003*** was -15.77 D, while in this study it's -14.18 D.

2. Axial length

In ***Horgan, 2005*** was 29.3 mm, In ***Arne JL 2004*** was 28.43 mm, in ***Fernandez-Vega, 2003*** was 26.0 mm, while in this study it's 29.09 mm.

3. Number of eyes

In ***Emarah AM, 2010*** was 28, in ***Gabric, 2002*** was 72, in ***Horgan, 2005*** was 62, in ***Arne JL 2004*** was 36, in ***Fernandez-Vega, 2003*** was 190, in ***Guell, 2003*** is 44, while in this study it's 10.

4. BCVA

In ***Emarah AM, 2010*** is 0.39 improved to 0.61 after 1 year of surgery, in ***Horgan, 2005*** is ≥ 0.5 in 52% of cases improved to ≥ 0.5 in 79.4 % of cases after 4 year of surgery, in ***Arne JL 2004*** improved by 83.3% better than pre-operative after 1 year of surgery, in ***Fernandez-Vega, 2003*** is 0.37 improved by 83.7% better than pre-operative in ***Guell, 2003*** is ≥ 0.5 in 63.2% of cases improved to ≥ 0.5 in 82.9 % of cases, in ***Gabric, 2002*** is 0.5 in 72% of cases improved to ≥ 0.5 in 83.3 % of cases after 4 year of surgery while in our study is 0.09 improved to 0.28 after 3 months after surgery,.

5. Residual error of refraction (spherical equivalent)

In ***Emarah AM, 2010*** was -0.99 ±0.88 D**,** in ***Horgan 2005*** was -1.09 ±1.34 D, in ***Fernandez-Vega, 2003*** was -1.22 D, in ***Guell,*** in ***Arne JL 2004*** was -1.88 ±0.83 D, ***2003*** was -1.05 D, in ***Gabric, 2002*** was 70.8% emmetropia, while in this study it's -1.83 D.

6. RD rate

In ***Emarah AM, 2010*** not counted, in ***Gabric, 2002*** was 1 eye 0.72%, in ***Horgan, 2005*** was 2 eyes 3.2%, in ***Arne JL 2004*** was 2 eyes 2.59%, in ***Fernandez-Vega, 2003*** was 2.10%, in ***Guell, 2003*** was not counted, while in this study it's not counted.

No RD was seen in any of our cases. This can be explained by:

1) The short follow-up period in our study (3 months), as the incidence of RD tends to occur at later stages.

2) The meticulous pre-operative selection, as all patients had a thorough 3-mirror examination of the retinal periphery.

3) The fact that none of the cases had an (YAG) capsulotomy. It has been documented that RD incidence increases after YAG laser posterior capsulotomy.

The absence of cases of PCO in our series can again be attributed to the short follow-up period.

The most vision-threatening complication of RLE is RD, with incidence from 8.1% **(*Rosen ES 2008).*** to 1.5-2.2% ***(Neuhann IM 2008).*** In a normal population, RD occurs in 1/8500 eyes **(*Koch DD 2005).*** The odds of RD however, can increase to 1/850 eyes in cases of myopia greater than -10.0 D in unoperated eyes – 0.68% **(*Ruiz-Moreno JM 2008).*** and in eyes after cataract extraction with IOL implantation. Retinal complications, especially in highly myopic eyes after refractive surgery such as RLE, are mainly attributed to two possible causes.

- Higher incidence of predisposing retinal lesions in myopic eyes and
- A hypothesis that refractive surgery may induce some iatrogenic factors, which can increase the incidence of such pathology **(*Ruiz-Moreno JM 2008).***

To avoid RD, careful preoperative funduscopic examination with scleral depression should be made to assess the state of the vitreous body. Intraoperatively, the minimal disturbance of intraocular environment is of great importance **(*Ruiz-Moreno JM 2008).***

Prophylactic laser therapy of lattice degeneration in myopic eyes is of modest efficacy and should be avoided instead. ***(Fernández-Vega L, et al 2003).***

Conclusion

Patients of all ages with anisometropic amblyopia must be encouraged to enter a management programme with clearly stated goals and outcomes with frequent follow up to monitor progress and provide necessary counselling and encouragement. Successful reversal not only provides visual rehabilitation but also improves the quality of life as well as self-confidence, and offers greater chance of employment. To fully explore the benefits of amblyopia therapy in adults, a large-scale multi-centre randomised clinical study is required at the regional level.

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