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# EFFICACY OF LASIK SURGERY IN TREATMENT OF ANISOMETROPIC HYPERMETROPIC AMBLYOPIA IN ADULTS

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## ABSTRACT

**PURPOSE :** To find out the effect of LASIK on visual acuity, spherical equivalent and stereopsis in anisohypermetropic amblyopia in adults.
**METHODS :** Prospective interventional study was done on 11 anisohypermetropic amblyopes in which conventional therapy had failed. These patients underwent LASIK surgery and the results were analysed at 3 month of follow up.
**RESULTS :** Mean age of the patients was 22.91 ± 4.59 ( Range 19 – 32 years ). The best corrected visual acuity improved from a mean of 0.32 ± 0.13 preoperative to 0.46 ± 0.20 postoperative ( p value < 0.05 ). The SE decreased from a mean of +3.53 ± 0.97 to +1.19 ± 0.49 ( p value < 0.05 ), there was no significant change in stereopsis.
**CONCLUSION :** LASIK is a safe and better alternative for refractive correction in cases of adults anisohypermetropic amblyopia.

## KEYWORD

Prospective Interventional, Anisometropic, Ucva And Bcva

## ARTICLE HISTORY

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## INTRODUCTION

Amblyopia is defined as unilateral or bilateral diminution of vision caused by form vision deprivation and or abnormal binocular interaction, which is correctable if appropriate therapy is applied at appropriate time1. Unless it is successfully treated in early childhood, amblyopia usually persists into adulthood and is the most common cause of monocular visual impairment among children, young and middle aged adults2. Amblyopia due to unequal refractive power of two eyes is known as anisometropic amblyopia. Reducing anisometropia is an important target for improving visual acuity and achieving binocular vision. It is difficult to tolerate glasses because of disparity of images. Contact lenses can eliminate the problem of unequal magnification, but their use is limited because of difficulty in handling, chances of infection, corneal ulcer, and socioeconomic reasons in our setup. Refractive Surgery according to some reports has shown better visual results. We undertook this study and report our results of LASIK in anisohypermetropic amblyopia in adults.

**STUDY DESIGN** – Prospective Interventional Study

## MATERIALS AND METHODS

The study was done from October 2011 to april 2012. This included eleven eyes diagnosed as anisometropic amblyopia as per inclusion criteria. The project was approved by institutional ethical committee. Informed consent was taken after explaining the nature and possible consequences of the treatment. Inclusion criteria were patients in the age group of 18 to 40 years, primary hyperopia upto + 4.00 DS, no history of corneal surgery, corneal pathology or systemic illness, no opacification of refractive media with failed conventional therapy for 6 months. Exclusion criteria were previous intraocular surgery, posterior segment pathology, ocular inflammation or infection, corneal scarring, systemic illnesses like diabetes mellitus, rheumatoid arthritis, systemic lupus, epilepsy, glaucoma, pachymetry < 500µ, dry eye ( schirmer test < 5.0mm ), evidence of keratoconus, keratometry reading < 42.0 D or > 47.0 D, astigmatism > 3.0 D. Preoperative work up was done which included uncorrected and best corrected visual acuity (UCVA and BCVA), cycloplegic refraction, pachymetry, orbscan (to measure corneal topography, corneal thickness, corneal diameter, pupil diameter, keratometry), aberrometry, schirmer test, tonometry, direct and indirect ophthalmoscopy, slit lamp biomicroscopy, orthoptic examination, binocularity status examined by titmus stereoacuity test. Contrast sensitivity was measured by pelli robson chart. The non amblyopic eye having refractive error was also treated by LASIK, but for the project parameter evaluation was done only for the amblyopic eye. Antibiotic eyedrop (0.3% Moxiflox qid) were given 2 days prior to surgery. LASIK surgery was performed as per the standard protocol of hospital using Technolas 100 excimer laser and microkeratome XP. Antibiotic eye drops were instilled. Corneal flap of 120-140µ thickness depending on the thickness of the cornea and keratometric value was made. Excimer laser ablation was done after lifting the corneal flap. The flap was replaced onto the stromal bed with wet merocil sponge leaving no stria in the flap. Post-operatively patients were put on Prednisolone Acetate eye drops 4-6 times in a day for 4 weeks and Artificial tears 4 times a day for 3-6 months. Postoperative follow up was done at day 1, 1week, 1 and 3month and assessment of uncorrected and best corrected visual acuity, contrast sensitivity, refraction, anterior segment evaluations especially interface debris,

fundus examination, ocular deviation, binocularity, orbscan was done at 3month.

## RESULTS

The study included 11 eyes of 11 patients with unilateral anisohypermetropic amblyopia where conventional therapy failed. The age of patients ranged from 19 years to 32 years. Mean age was 22.91 ± 4.59 years. There were 8 male patients (72.73%) and 3 female patients (27.27%). Results were analyzed at 3 month of follow up after LASIK surgery.

## IMPROVEMENT IN VISUAL ACUITY AFTER LASIK

The Preoperative mean UCVA (decimal equivalent) was 0.19±0.10 (ranging from 0.02 to 0.33) and the mean postoperative UCVA (decimal equivalent) was 0.44 ± 0.20 (ranging from 0.17 to 0.67). The Preoperative mean BCVA (decimal equivalent) was 0.32 ± 0.13 (ranging from 0.17 to 0.50) and the mean postoperative BCVA (decimal equivalent) was 0.46 ± 0.20 (ranging from 0.17 to 0.67). (table 1 and figure 1)

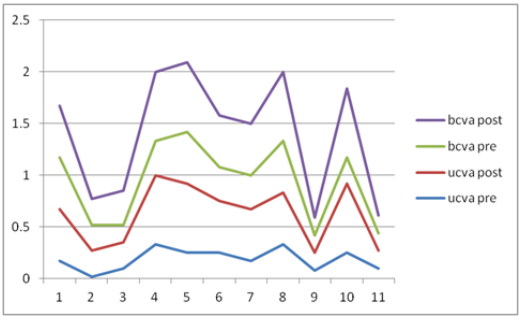
The UCVA improved from a mean of 0.19 ± 0.10 preoperative to 0.44 ± 0.20 postoperative with t-test showing a value of -6.819 (p value = 0.001, paired t- test) showing statistically significant.

The BCVA improved from a mean of 0.32 ± 0.13 preoperative to 0.46 ± 0.20 postoperative with t-test showing a value of -3.407 (p value = 0.013, paired t-test) which again showing statistically significant.

**TABLE 1 :** Showing preoperative and postoperative visual acuity of all the patients.

| UCVA PRE (decimal equivalent) | UCVA POST (decimal equivalent) | BCVA PRE (decimal equivalent) | BCVA POST (decimal equivalent) |
|---|---|---|---|
| 0.17 | 0.50 | 0.50 | 0.50 |
| 0.02 | 0.25 | 0.25 | 0.25 |
| 0.10 | 0.25 | 0.17 | 0.33 |
| 0.33 | 0.67 | 0.33 | 0.67 |
| 0.25 | 0.67 | 0.50 | 0.67 |
| 0.25 | 0.50 | 0.33 | 0.50 |
| 0.17 | 0.50 | 0.33 | 0.50 |
| 0.33 | 0.50 | 0.50 | 0.67 |
| 0.08 | 0.17 | 0.17 | 0.17 |
| 0.25 | 0.67 | 0.25 | 0.67 |
| 0.10 | 0.17 | 0.17 | 0.17 |

**FIGURE 1: Line diagram showing comparison between mean value of preoperative and postoperative UCVA and BCVA of all the patients.**




On evaluating BCVA, out of 11 patients, 4 patients (36.36 %) did not gain any line, 4 patients (36.36%) gained one line, 2 patients (18.18%) gained two lines, 1 patient (9.10%) gained three line, none of the eyes lost any line on BCVA. The mean increase in the total postoperative BCVA in snellen lines was 1.00±1.00.

## COMPARISON OF REFRACTION BEFORE AND AFTER LASIK

mean The mean preop sphere (DS) was +3.18 ± 0.99 (ranged from + 1.75 to +4.00) and the mean postop sphere (DS) was +0.72 ± 0.38 (ranged from + 0.25 to + 1.25). The mean preop cylinder (DC) was +0.82 ± 0.60 (ranged from 0.00 to + 1.50) and the mean postop cylinder (DC) was +0.59 ± 0.48 (ranged from 0.00 to +1.50). The preop SE (DS) was +3.35 ± 0.97 (ranged from + 2.00 to + 4.75) and the mean postop SE (DS) was +1.19 ± 0.49 (ranged from +0.50 to +1.75). The data is shown in table 2.

**Table 2 : Showing preoperative and postoperative sphere, cylinder and spherical equivalent of all the patients.**

| Sphere pre (DS) | Sphere post (DS) | Cylinder pre (DC) | Cylinder post (DC) | SE pre (DS) | SE post (DS) |
|---|---|---|---|---|---|
| 4.00 | 0.25 | 0.00 | 0.50 | 4.00 | 1.00 |
| 4.00 | 1.00 | 1.50 | 0.50 | 4.75 | 1.75 |
| 4.00 | 1.25 | 1.25 | 0.75 | 4.62 | 1.62 |
| 4.00 | 0.50 | 0.75 | 0.50 | 4.37 | 0.75 |
| 2.25 | 1.00 | 0.50 | 0.50 | 2.50 | 1.25 |
| 1.75 | 0.25 | 1.25 | 0.50 | 2.37 | 0.50 |
| 4.00 | 0.50 | 0.00 | 0.75 | 4.00 | 0.82 |
| 2.00 | 1.00 | 1.50 | 0.50 | 2.75 | 1.25 |
| 2.00 | 0.50 | 0.00 | 0.25 | 2.00 | 0.62 |
| 4.00 | 0.50 | 1.25 | 1.25 | 4.00 | 2.00 |
| 3.00 | 1.25 | 1.00 | 0.50 | 3.50 | 1.50 |

The sphere decreased from a mean of +3.18 ± 0.99 preoperative to +0.72 ± 0.38 postoperative on wilcoxon signed ranks test, t value of 7.68 (p value = 0.003) statistically significant .The data is shown in figure 2.

The cylinder decreased from a mean of +0.82 ± 0.60 to +0.59 ± 0.48 on wilcoxon signed ranks test. t value was -0.21 (p value = 0.94). The difference was non significant. The data is shown in figure 3. The SE decreased from a mean of +3.53 ± 0.97 to +1.19 ± 0.49 on wilcoxon signed ranks test.t value of was 9.35 (p value = 0.003). The difference was statistically significant. The data is shown in figure 4.

**FIGURE 2 : Line diagram showing comparison between preoperative and postoperative sphere of all the patients.**

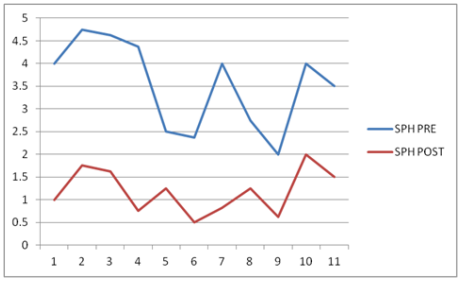



**FIGURE 3: Line diagram showing comparison between preoperative and postoperative cylinder of all the patients**

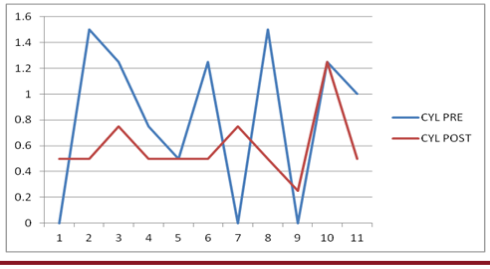
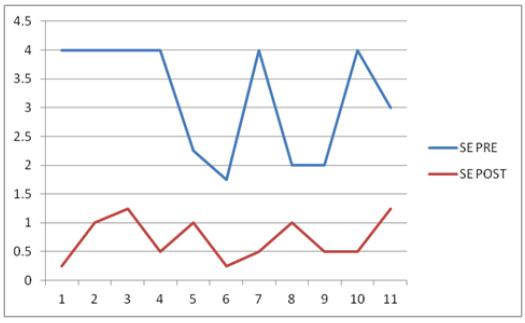


**FIGURE 4: Line Diagram Showing Comparison Between Preoperative And Postoperative Spherical Equivalent Of All The Patients.**




## EFFECT OF LASIK ON STEREOPSIS

Stereopsis was measured with the help of titmus fly stereoacuity test before and after lasik. Out of 11 patients, 3 patients (27.28%) experienced increase in stereopsis after lasik and in remaining 8 patients (72.72%), there was no change in stereopsis after surgery. Mean preoperative stereopsis was 187.27 ± 115.23 and postoperatively it increased to 200.00 ± 110.63 (p value = 0.111) using paired t–test.The difference was non significant(table 3).

**TABLE 3: Showing Stereopsis Of All The Patients Preoperatively And Postoperatively.**

| S.NO | PREOP | POSTOP |
|---|---|---|
| 1. | 80 | 80 |
| 2. | 400 | 400 |
| 3. | 200 | 200 |
| 4. | 140 | 200 |
| 5. | 60 | 80 |
| 6. | 140 | 200 |
| 7. | 140 | 140 |
| 8. | 200 | 200 |
| 9. | 200 | 200 |
| 10. | 400 | 400 |
| 11. | 100 | 100 |

## EFFECT OF LASIK ON CONTRAST SENSITIVITY

Out of 11 patients, 3 patients (27.28%) experienced increase in contrast sensitivity after lasik and in remaining 8 patients (72.72%), there was no change in contrast sensitivity after surgery. Mean contrast sensitivity preoperatively was 1.25 ± 0.27 and postoperatively increased to 1.34 ± 0.26 (p value was 0.8) using wilcoxon signed ranks test.The difference was non significant (table 4).

**TABLE 4: Showing Contrast Sensitivity Of All The Patients Preoperatively And Postoperatively.**

| S.NO | PREOP | POSTOP |
|---|---|---|
| 1. | 1.50 | 1.50 |
| 2. | 0.90 | 0.90 |
| 3. | 1.35 | 1.35 |
| 4. | 1.20 | 1.50 |
| 5. | 1.65 | 1.65 |
| 6. | 1.20 | 1.50 |
| 7. | 1.50 | 1.50 |
| 8. | 1.50 | 1.50 |
| 9. | 0.90 | 1.20 |
| 10. | 0.90 | 0.90 |
| 11. | 1.20 | 1.20 |

Contrast sensitivity was measured with pelli robson contrast sensitivity chart before and after lasik.

## DISCUSSION

Anisometropic amblyopia remains one of the most common forms of amblyopia and is usually diagnosed at the later age due to lack of any obvious manifestations like strabismus. The traditional therapy for anisometropic amblyopia consists of correcting refractive correction with spectacles or contact lenses followed by occlusion or penalization of sound eye. Spectacle correction produces aniseikonia and aniseikonia of 5–6 % cannot be readily fused leading to suppression of amblyopic eye and thereby limiting the effectiveness of amblyopia therapy3. Contact lenses are an alternate treatment for anisometropia, however their use is limited in our setting due to various inherent problems like infection, ulceration, care required for handling of contact lenses & socioeconomic problems. Because of late reporting of these patients conventional therapy is usually not successful.

Recent advances in refractive surgery for amblyopia suggest that surgical therapy may be viable alternate option to conventional therapy for anisometropic amblyopia. Holmes et al reported success rate in amblyopia due to anisometropia of >6 diopter was only 25% with conventional treatment modalities4. The success rate of conventional therapy is directly related with degree of anisometropia. Despite our best efforts till date to treat anisometropic amblyopia, one third children will not achieve visual acuity of 6/12 or better3. So early utilisation of non conventional treatment including refractive surgeries might be warranted in select cases of anisometropic amblyopia with identifiable risk factors like anisometropia of more than 6D. Poor compliance, age of six year or older at initiation of treatment, astigmatism of > 1.50 D and poor visual acuity at the start of treatment are candidates ,who usually poorly respond to conventional therapy. These are the candidates in whom refractive surgery might be considered.

Excimer laser refractive surgeries have been successfully used in treatment of myopia, hypermetopia and astigmatism in adults. Most adult patients who undergo LASIK are satisfied with the outcome5. The treatment success for anisometropic amblyopia is achieved only in two third of cases. Consideration of alternate treatment which is less dependent on glasses and family compliant such as refractive surgery is reasonable consideration.& refractive surgery could play an important role in treating these difficult subset of patients like conventional therapy failure or successfully treated patients with subnormal vision and cases of residual amblyopia.

Lasik has been found to be useful in adult anisometropic amblyopia in various studies, and there are limited studies regarding use of LASIK in hypermetropic amblyopia.

K.Sakatani et al6, 2004 have reported that LASIK improves BCVA in 42.8 % of eyes, there was no change in BCVA in 52.4 % eyes and there was worsening of visual acuity in 4.8 % of eyes. In our study, BCVA was increased in 63.64 % of eyes, unchanged in 36.36 % of eyes and no loss of BCVA in any of the patient. The probable reasons for better outcome could be due to inclusion of refractive error up to +4D cases in our study. K.Sakatani et al6 studied both amblyopic and non amblyopic eyes, 42.1% of patients were amblyopic and out of them 31.6 % of patients were anisometropic, 21.1% were srabismic amblyopes and 5.2 % of patients were combined. 52.4 % had myopic astigmatism, only 33.3 % had hyperopic and 14.3 % had mixed astigmatism. In our study all the 11 patients were anisometropic hyperopic amblyopes and out of these 27.27% were simple hypermetropic and 72.73% were hypermetropic with astigmatism. K.Sakatani et al6 study was retrospective and change in refraction, effect on stereopsis and contrast sensitivity after LASIK was not studied. However, Our study was a prospective study and we compared the mean spherical manifest refraction, change in stereopsis and contrast sensitivity were not found to be significant.

Tamer Adel Refai, et al7 2011 assessed the correction of refractive error with LASIK in 20 adult anisometropic amblyopic eyes of 20 patients and reported that 16 out of 20 cases (80%) had gained one to five lines of best corrected Snellen visual acuity while 4 cases (20%) had same visual acuity as preoperative. In our study, out of 11 patients, 1 patient (9.10%) gained three line, 2 patients (18.18%) gained two lines, 4 patients (36.36%) gained one line, 4 patients (36.36 %) does not gain any line and no eye has lost any snellen line of BCVA.

Tamer Adel Refai et al studied the effect of age and sex on postoperative increase in BCVA. They divided the patients into two groups < 30 years and > 30 years. We have also divided the patients into two groups < 23 years and > 23 years. Our results are in agreement with their study that there was no significant correlation between increase in postoperative BCVA and age or sex of the patients. Rafai et al102 studied the effect of preoperative spherical equivalent on the postoperative increase in BCVA and patients were divided into two groups SE < 6 D and SE > 6 D. Their result showed highly significant correlation in patient with SE > 6 D. We however could not divide the patient in two groups as our sample size was small and range of refractive error was limited and hence cannot comment upon the same.

Das et al8 studied the changes in visual acuity and contrast sensitivity following LASIK in adult anisometropic amblyopia. In this study they included cases of myopic astigmatism, compound astigmatism, hyperopic astigmatism and simple myopic astigmatism. SE ranged from 0 to > 6 D in myopic and 1.5 to > 3 D in hypermetropic category respectively. Following LASIK 29.62 % patient's experienced one line improvement in postop UCVA, 11.11 % had two line improvements and 11.11 % patient had three line of improvement and postop UCVA was unchanged in 29.62 % of patients. In hyperopia postop UCVA was increased in 81.18 % and in myopia 31.25 % of the patients .In our study also, there was significant improvement in BCVA, which are consistent with above study. Out of 11 patients, 3 patients (27.28 %) experienced increase in contrast sensitivity after LASIK and remaining 8 patients (72.72 %) maintained same contrast sensitivity after surgery. Mean contrast sensitivity preoperatively was 1.25 ± 0.27 and postoperatively increased to 1.34 ± 0.26 (p value = 0.8, wilcoxon signed ranks test) which shows a non significant difference

There are conflicting reports regarding status of binocularity after LASIK. Impaired binocularity has been reported after refractive surgery by Godts, et al9. Improved stereopsis after refractive surgery is rarely reported and usually found in pediatric population10. However, Wasserman et al11 has reported improvement in stereo acuity from 100 secs of arc to 40 secs of arc after LASIK in adult anisometropic amblyopia. In our study, out of 11 patients, 3 patients (27.28 %) experienced increase in streopsis after LASIK and remaining 8 patients (72.72 %) maintained the same stereopsis after surgery. Mean stereopsis preoperatively was 187.27 ± 115.23 and postoperatively increased to 200.00 ± 110.63 (p value = 0.111, paired t–test) which shows a non significant difference.

## CONCLUSION

LASIK is a safe and better alternative for refractive correction in cases of adults anisohypermetropic amblyopia. It can be used as an last modality of treatment having high refractive error with amblyopia and which has not been corrected previously. It improves visual acuity,contrast sensitivity and stereopsis.

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