

## **LASIK To Improve Visual Acuity in Adult Neglected Refractive Amblyopic Eyes: Is It Worth?**

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*Abstract.* The objective of this study is to establish if the correction of the refractive error with LASIK could lead to an improvement in adult neglected refractive amblyopia. A retrospective review of patients that underwent LASIK for the correction of adult refractive amblyopia was studied. Fourteen eyes were myopic, 3 eyes were hypermetrope and one eye was mixed astigmatic. Nine patients gained one or two lines (50%) all were from the myopic group, eight patients did not show any change (44.4%), and one patient lost one line (5.5%) and was astigmatic hypermetrope. A positive correlation was found between the pre and post operative; best corrected visual acuity between the improvement and satisfaction of the patients; between the degree of pre operative refractive error and the improvement in the best corrected visual acuity as well as between the pre and post operative refractive error. Adult patient with amblyopic eye can enjoy better vision after the procedure. In fact, refractive surgery for adult wishing to correct their neglect amblyopic eye previously thought to be refractory to visual rehabilitation may be considered.

*Keywords:* LASIK, Amblyopia, Myopia, Hyperopia.

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## **Introduction**

Amblyopia is a reduction of the best corrected visual acuity to less than 20/30 in one eye, without other visible sign of eye diseases<sup>[1]</sup>. Traditional clinical concept is that occlusion therapy is effective only in infant and young children when the visual system is sufficiently flexible for cortical modification to occur. Several recent reports have shown that some improvement in visual function occurs in adult amblyopic eyes when the normal fellow eye has lost vision<sup>[2-4]</sup>. LASIK became a safer way to correct refractive error, especially when glasses are not applicable and the patients are not interested to wear contact lenses<sup>[5-6]</sup>. The aim of this work is to establish if the correction of the refractive error with this technique could lead to an improvement in the amblyopia.

## **Subject and Method**

A retrospective review based on the charts of the patients that underwent LASIK for the correction of adult refractive amblyopia during the year of 2005 included 18 eyes of 18 patients; the surgery was done at Eye Care Center, Jeddah, Saudi Arabia. All of these patients had unilateral myopia less than 10 diopter with maximum of up to 2 cylinder of astigmatism, hypermetropia not more than 4 diopter and mixed astigmatism not more than 3 diopter differences between the 2 axes. The fellow eye was emmetropic. Glasses were not worn for optical reasons and all of these patients were reluctant to wear contact lenses. The procedure was explained to the patient with the possibility of limited improvement post operative. An approved informed consent was obtained from the patients.

Contact lenses were worn prior to surgery to detect any post operative chance of diplopia. Preoperative evaluation included the routine ophthalmological examination to exclude any ocular diseases, any systemic diseases that could interfere with the healing process of the cornea, such as the collagen diseases. Inquiry about the educational level and the reason why not any attempt was done to correct the amblyopia. Routine LASIK tests for dry eye, corneal topography, pachymetry, scotopic pupil size, ocular tension, cycloplegic refraction and retinal examination were done.

The LASIK procedure was carried as follows: After application of topical anesthesia (benoxinate minims), the microkeratome handle was applied over the cornea with centration guided by the entrance pupil. Proper suction was verified by applanation tonometry (65 mmHg). The motor was advanced and a superior hinged lamellar flap was created. Ablation was performed by the Allegretto wave light laser. The stromal bed was washed by balanced salt solution (BSS, Alcon Laboratory, Fort Worth, TX). The flap was folded back in position, painted by a wet sponge to assure proper repositioning. The flap was left to dry for two minutes. Eye protection was achieved by a transparent hard shield. Patients received tobramycin, dexamethasone eye drops. Ofloxacin 0.3% eye drops and preservatives free tear natural for 15 days. Patients were followed after one week, one month, three months and six months for flap complications, refraction, and visual acuity. Patient satisfaction was given a score from 1 to 10 based on his improvement in vision, better feeling of binocular vision, better field sensation at the site of the amblyopic eye, problem with low illumination and did he regret that he didn't do the surgery early in his life or not.

### **Results**

The study included 18 eyes of 18 patients with unilateral neglected refractive Amblyopia. The age of the patients ranged from 19 years to 35 years with a mean of 27.8 +/- 5.5 years. Male patients were 7 (39%) and female patients were 11 (61%). The preoperative spherical equivalent ranged from -10 to +4 (with a mean of - 3.8 +/- 5.3), 14 eyes were myopic, 3 eyes were hypermetropes and one eye was mixed astigmatic. The postoperative spherical equivalent ranged from -1 to 0 with a mean of 0.2 +/- 0.4 (Fig. 1). Best spectacles corrected visual acuity ranged from 0.3 to 0.9 with a mean of 0.5 +/- 0.19. The best corrected visual acuity postoperative ranged from 0.2 to 0.9 with a mean of 0.5 +/- 0.2. Improvement was recorded by gaining or losing visual acuity lines. The improvement ranged from loss of 1 line (-1) to gain of 2 lines (2) with a mean of 0.55 + 0.78 line gain. Nine patients gained one or two lines (50%) all were from the myopic group and patients did not show any change (44.4%), one patient lost one line (5.5%) and was astigmatic hypermetropes (Fig. 2).

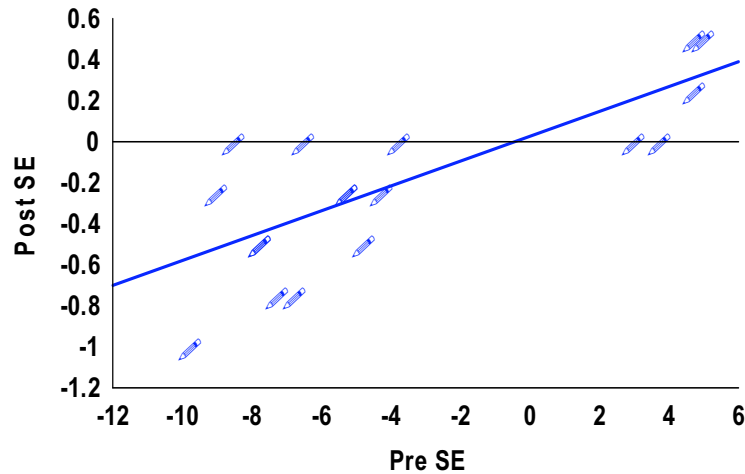


Fig. 1. Correlation between pre SE and post SE.

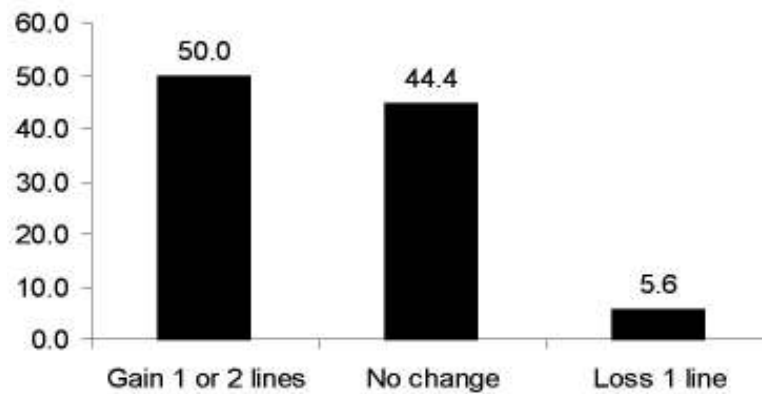


Fig. 2. Best corrected post operative visual acuity change.

The degree of satisfaction ranged from 6 to 10 with a range of 8.6. All of the fair satisfied patients were from the hypermetropic group. Using the SPSS statistic software, the correlation between the pre operative best visual acuity, post operative best visual acuity, and amount of error corrected was evaluated. Improvement in best visual acuity, degree of satisfaction, age and sex were assessed by linear regression analysis. The significance was tested with the paired "student's" *t* test. A positive correlation was found in our cases between the pre and post operative best corrected visual acuity (Pearson's correlation= 0.692, significant at the 0.01 level 2-tailed). There was a significant relation between the improvement and the satisfaction of the patients (Pearson's

correlation = 0.715, significant at the 0.01 level 2-tailed). There was also a positive correlation between the degree of pre operative refractive error and the improvement in best corrected visual acuity (Pearson's correlation = 0.923, significant at the 0.01 level 2-tailed). There was a positive correlation between the pre and post operative refractive error (Pearson's correlation = 0.770, significant at the 0.01 level 2-tailed). No other relation was found in relation to age or sex in relation to improvement or satisfaction. Most of our patients had a low degree of education till the secondary school (78%), only 4 (22%) patients' finished higher education. All these patients did not have the perseverance (either due to the parents or the patients themselves) for occlusive therapy to treat the amblyopia.

### Discussion

It was well known that when it comes to amblyopia in a patient who is past early childhood, there is little that can be done to improve visual acuity. Traditional teaching is that therapy is effective only in infants and young children, when the visual system is sufficiently plastic for cortical correction to occur. However, some has observed that little improvement in visual function occurs in adult amblyopic eyes when the normal fellow eye has lost vision<sup>[2-4]</sup>. Also, it was observed that some patients, after doing bilateral LASIK surgery with an amblyopic eye, were excited as they had never seen as clearly out of their bad eye before despite all that was known to the contrary.

Most of the reported studies of the use of refractive surgery to improve vision were performed on amblyopic children eye and all showed improvement in BCVA after the procedure<sup>[5-11]</sup>. This study was carried out to retrospective review; the chart of consecutive amblyopic patients that were seen during the year 2005. Lanza *et al.*<sup>[2]</sup> in a study on adult amblyopic(38 eyes ranging from -14.63 D to + 3.75 D), but using photorefractive keratectomy (PRK), showed that most of their patients had an improvement in BCVA, mainly in those with mild to moderate amblyopia. At the end of 6 months, BCVA ranged between 0.25 and 1.3 lines with a significant difference preoperative (0.2 and 0.7 lines). Valente *et al.*<sup>[7]</sup> in a study on adult high myopic anisometropia stressing on preoperative binocular orthoptic evaluation to avoid diplopia, found that most of the amblyopic eye had improvement of BCVA without postoperative diplopia. He explained the results as the correction of the

dominant eye first preserve the fixation after the refractive surgery. In cases when the suppressed eye was done first a temporary postoperative diplopia was observed until the dominant eye was treated.

The improvement in BCVA in the patients may have a different explanation: First the correction of ametropia after the surgery, second the improvement of the corneal refractive surface creates a better optical system that allows better vision than using spectacles. Finally, the improvement may be a real change in the amblyopic eye that allows a better function in the amblyopic eye as seen in cases where an amblyopic eye can recover a level of visual function when the previously normal fellow eye is lost to a disease<sup>[12-15]</sup>. In post refractive cases, a sharper image in the operated eye could force the brain to use their previous lazy eye as most of the improvement in the cases where in those that had a low grade of myopia. These support the idea that the improvement after refractive surgery is due to relative magnification and relief from the spherical aberration rather than a real recovery from amblyopia. All these cases have a better seeing eye<sup>[12,15]</sup>.

In conclusion, this study did not emphasize on other visual function related to amblyopia, such as binocular function and orthoptic examination pre operative. However, none of the patients developed post operative diplopia. This study does not imply that refractive surgery can be considered a cure for amblyopia, but rather that adult patient with amblyopic eye can enjoy better vision after the procedure. In fact, refractive surgery for adult wishing to correct their neglect amblyopic eye previously thought to be refractory to visual rehabilitation by conventional method especially for moderate degree of myopia should be highly considered.

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## هل محاولة تصحيح الإبصار بالليزر (اللازك) في حالات كسل العين لدى البالغين ذات جدوى إيجابية؟

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المستخلص. تهدف الدراسة لمعرفة ما إذا كان تصحيح الانكسار بواسطة الليزر يمكن أن يؤدي، إلى تحسين النظر في حالات كسل العين لدى البالغين. وقد تم مراجعة ١٨ عيناً لـ ١٨ مريض أجريت لهم عمليات تصحيح الإبصار بالليزر، وتشمل ١٤ عيناً بها قصر نظر، و ٣ عيون طول نظر، وعين بها اللانقطية مختلطة، وتم تقييم العلاقة بين درجة الضعف قبل وبعد العملية، ومدى تحسن النظر بعد العملية، ودرجة الرضا بعد العملية وقيمت بطريقة الارتداد الخطي. وقد أظهرت النتائج أن ٩ مرضى تم تحسن نظرهم خطأً أو خطين (٥٠٪) من العلامات، ٨ مرضى (٤٤,٤٪) لم يطرأ تغيير على نظرهم، ومريض (٥,٥٪) فقد خطأً من علامات النظر. معظم الرضا من العملية كان لحالات قصر النظر، ووجدت علاقة موجبة إحصائياً بين درجة الإبصار، رضا المريض، ودرجة الرضا قبل وبعد العملية. من الممكن الأخذ بجدية تصحيح الإبصار بالليزر في حالات الكسل المهمل لدى البالغين، خاصة في حالات قصر النظر، ولا ننصح به في حالات طول النظر، واللانقطية المركزية، وذلك لعدم رضاهم عامةً بعد العملية.