To Evaluate Monocular and binocular Visual Acuity in LASIK POP 1 day and POP 1 month.

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Abstract: This study aims to evaluate the visual acuity of LASIK patients monocularly and binocularly on post-operative day 1 and at 1 month. A cohort of patients was assessed using standard visual acuity tests to compare early post-operative outcomes with longer-term improvements. Results indicated significant visual acuity enhancement within the first month, with marked improvements in both monocular and binocular vision. Post-operative day 1 results showed variability, stabilizing by the 1-month mark, highlighting the progressive nature of visual recovery following LASIK surgery. These findings underscore the efficacy and rapid recovery timeline of LASIK procedures.

Material and Methods: A vision chart is utilized to assess visual acuity, while an auto-refractometer provides an estimate of the refractive error. A retinoscope is employed to determine the precise refraction. Corneal topography is used to examine the shape of the cornea, and a Pentacam measures corneal thickness. Biometry helps evaluate the axial length of the eye, and wavefront analysis is used to identify aberration points on the cornea.

Results: A total of 20 patients underwent Contura LASIK surgery, consisting of 10 males and 10 females, aged between 20 and 40 years. The mean age of the female participants was 23.3 years, and the mean age of the male participants was 25.5 years. The pre-operative mean visual acuity was 0.937.

Conclusion: The study reveals that visual acuity decreases immediately after surgery, with recovery taking approximately 1 week to 1 month to reach full visual acuity. Post-operative recovery varies depending on the type of refractive surgery performed. For instance, patients undergoing ASA surgery required about 1 month for complete recovery, whereas those who underwent FS surgery regained their visual acuity more quickly, with minimal symptoms. Additionally, patients who experienced symptoms such as watering, pain, or difficulty opening their eyes had visual acuity ranging from 6/24 to 6/12, while asymptomatic patients exhibited visual acuity between 6/12 and 6/6, both monocularly and binocularly.

Keywords: Snellen's Chart, Symptomatic, Myopia, Astigmatic, Monocularly, binocularly

INTRODUCTION

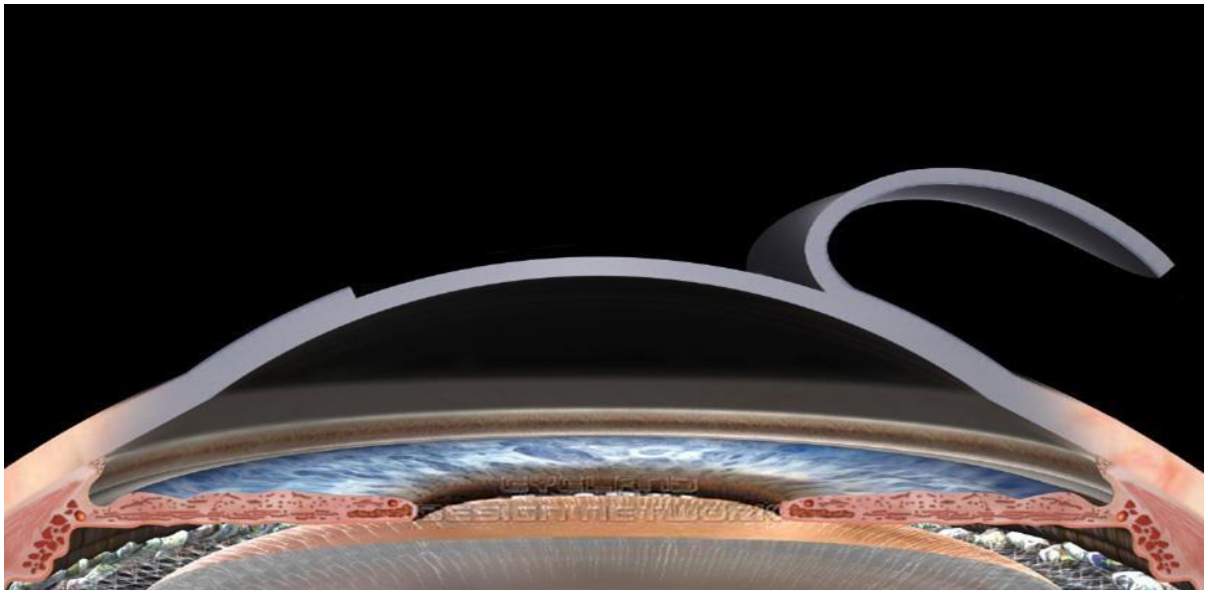
LASIK (Laser-Assisted In Situ Keratomileusis), commonly known as laser eye surgery or laser vision correction, is a widely used refractive procedure for correcting myopia (nearsightedness), hyperopia (farsightedness), and astigmatism. It is particularly effective for astigmatism since the condition arises from irregularities in the corneal shape. The surgery is performed by an ophthalmologist who uses a laser or microkeratome to reshape the cornea, enhancing the patient's visual acuity.

LASIK is typically recommended for individuals aged 18 to 22 and older, as vision needs to stabilize before surgery. It is essential that the patient's eye prescription remains stable for at least one year prior to the procedure. Pre-operative evaluations include pupillary dilation, patient education, and an assessment of corneal thickness using pachymetry, along with corneal topography to map the cornea's surface.

LASIK is suitable for patients with varying degrees of myopia, ranging from mild to severe. It has been demonstrated to correct myopia from -2.00 D up to -20.00 D, though it is most commonly performed on those with low to moderate myopia, between -0.5 D and -9.00 D. These patients have a higher likelihood of achieving emmetropia (perfect vision). Additionally, LASIK is considered safe and effective for treating hyperopia and astigmatism. It can predictably treat hyperopia up to +6.00 D, though most surgeons recommend limiting LASIK to those with hyperopia up to +4.00 D and astigmatism up to 5.00 D.

It is important to note that LASIK does not address presbyopia (age-related loss of near vision), so patients may still require reading glasses post-surgery. Furthermore, myopic shifts may occur later in life due to cataract formation.

During LASIK, the surgeon evaluates the cornea for astigmatism and other irregularities to determine the precise amount of corneal tissue to remove. Patients are often prescribed an antibiotic beforehand to reduce infection risk, and some may be given a mild oral sedative. Anaesthetic eye drops are administered to numb the eye prior to the procedure. Factors that may contraindicate LASIK include large pupils, thin corneas, and severely dry eyes.



Flap Creation Process

The procedure begins with a soft corneal suction ring applied to the eye to immobilize it. This step may cause minor side effects, such as small blood vessel breakage leading to subconjunctival hemorrhage (a harmless condition that resolves within weeks). Increased suction may cause a temporary dimming of vision in the treated eye. Once the eye is stabilized, the surgeon creates a corneal flap by cutting through the epithelium and Bowman's layer, either with a mechanical microkeratome (a blade) or a femtosecond laser, which creates a series of microscopic bubbles in the cornea. A hinge is left at one end of the flap, allowing it to be lifted and folded back to expose the underlying stroma for further treatment. This process, while effective, can cause some discomfort.

Refractive surgery, particularly LASIK (Laser-Assisted In Situ Keratomileusis), has revolutionized the management of refractive errors, offering a promising alternative to glasses and contact lenses. Over the years, advancements such as Contura Vision and femtosecond (FS) laser technology have improved surgical precision, patient safety, and post-operative outcomes. Contura Vision, a topography-guided LASIK, refines the laser treatment by focusing on individual corneal irregularities, leading to enhanced visual outcomes, particularly for those with higher-order aberrations. However, the recovery process varies among patients and depends on the type of refractive surgery performed, as well as individual anatomical and healing factors.

The primary aim of this study is to evaluate the post-operative visual acuity of patients undergoing Contura Vision, focusing on both monocular and binocular outcomes at key recovery milestones: post-operative day 1 and one month. Understanding the recovery timeline and visual outcomes is crucial, as LASIK patients often experience immediate fluctuations in vision. Typically, patients may notice blurring, halos, or even difficulty in performing daily activities within the first few days. These symptoms gradually resolve as the cornea heals, but the time to reach optimal visual acuity can vary significantly.

Different surgical methods yield different post-operative results. For example, Advanced Surface Ablation (ASA) procedures, which involve corneal epithelial removal, have longer recovery times due to epithelial regeneration. On the other hand, femtosecond laser-assisted LASIK (FS LASIK), which creates a corneal flap with precision, generally offers quicker visual recovery with fewer post-operative symptoms. Patients' experiences also differ based on their symptomatic response. Those with more severe symptoms such as eye watering, pain, or

difficulty keeping the eyes open often show delayed visual acuity improvement compared to asymptomatic patients.

Visual acuity, a critical indicator of the success of refractive surgery, is typically measured using a standard vision chart, and refractive errors are assessed pre- and post-operatively. The use of advanced diagnostic tools like topography, Pentacam, and wavefront analysis allows for a comprehensive understanding of the corneal structure, thickness, and potential irregularities. These measurements not only guide the surgical procedure but also provide insights into the expected recovery trajectory.

In this study, we observe 20 patients who underwent Contura LASIK surgery, comparing their visual acuity on post-op day 1 and at 1 month. Both monocular and binocular visual outcomes were analyzed, along with the correlation between symptomatic responses and visual recovery. The findings from this research provide valuable insights into the variability of post-operative recovery and the factors that may influence the restoration of visual acuity.

OBJECTIVES

Need for the Study:

In many hospitals across India, binocular single vision (BSV) is often assessed following LASIK surgery. However, there is a need to focus specifically on monocular vision to determine potential differences between the visual outcomes of each eye after surgery. This study aims to fill that gap by evaluating monocular vision post-LASIK and understanding the differences between the two eyes' visual performance.

Problem Statement:

Although substantial research has been conducted on post-LASIK outcomes like contrast sensitivity and glare, limited studies have examined visual acuity (VA) both monocularly and binocularly on the same day after surgery (Post-Op Day 1) and after 1 month (Post-Op 1 Month). Understanding this distinction could provide valuable insights into the recovery patterns of each eye.

Purpose of the Study:

The purpose of this study is to evaluate visual acuity on Post-Op Day 1 and Post-Op 1 Month, with a particular focus on comparing monocular and binocular vision outcomes after LASIK surgery.

Objectives of the Study:

The primary objective of this research is to investigate visual acuity, both monocularly and binocularly, immediately after LASIK surgery (Post-Op Day 1) and 1 month post-operatively (Post-Op 1 Month).

Assumptions:

This study assumes that the level of visual acuity increases immediately after LASIK surgery, particularly in patients experiencing post-operative symptoms.

Hypothesis:

1. Null Hypothesis (H_0):
   Patients will achieve 6/6 visual acuity monocularly and binocularly after surgery.
2. Alternate Hypothesis (H_1):
   There may be differences in visual acuity between the two eyes after surgery.

Operational Definitions:

This research not only considers the verbal responses of participants but also the non-verbal cues, such as body language and tone of voice, which may offer further insights. These mannerisms can be crucial in understanding the full impact of the surgery and the patient's recovery experience.

REVIEW OF LITERATURE

S.N O	Author Name	Title	Year of the Study and Place	Aim and Objectives	Methodol ogy	Conclusion
1	Hammon d, Stephen D Jr; Puri, Anil K; Ambati, Balamur ali K	Quali ty of visio n and patie nt satis factio n after LASI K	August 2004, Lippincortt Williams and Wilkins, Inc.	Is to review the literature and find characterist ics that lead to improved patient satis faction and better quality of vision. Contrast Sensitivity is decreased after LASIK (initially) returning to baseline it took	Pupil size has not been found to be correlated with night vision sy mptoms. Wavefront -guided ablations reduce higher- order aberration s in compariso n with traditional LASIK.	Preoperative characteristics such as: increased patient age, decreased corneal toricity, or increased pupil size reduce patient satisfaction. Intraoperative factors like decentration, ablation-zone size, active eye tracking, and wavefront guid ed ablations affect quality of vision. Finally, postoperative factors

				6-12 months after POP.		such as night vision symptoms, reduced contrast sensitivity, and re-treatment can lead to a decline in patient satisfaction. [8]

S.N O	Author Name	Title	Year of the Study and Place	Aim and Objectives	Methodol ogy	Conclusion
2	Steven C Schall horn MD [1], Sandor E Kaupp MD [1], David J Tanzer MD [1], ET.AL	Pupil size and qualit y of visio n after LASI K	Naval medical center, san diego, california, USA, december 2002	The quality of vision after LASIK	Laser with 6.0 mm ablation paatern without transition zone	Patients with large pupils had more quality of vision symptoms in the early postoperative period, but no correlation was observed 6 months after surgery.

3	Kerry D Solom on [1], L uis E Ferná ndez de Castro , Helg a P Sando val, Jo seph M Biber, Brian Groat, Kristi ana D Neff, Miche lle S Ying, John W Frenc h, Eric D Donne nfeld, Richar d L Lindst rom	LASI K world literat ure review : qualit y of life and patient satisfa ction	Magill Research Center for Vision Correctio n, Storm Eye Institute, Medical Universit y of South Carolina, Charlesto n, South Carolina **Decemb er 2008**	To analy ze the patien t report ed outco me of satisf action after LASI K surger y	A literature search conducted for the years 1988 to 2008 that included pertinent LASIK surgery information from the review of 2915 retrieved citations	Based on this review, worldwide, an average 95.4% of patients were satisfied with their outcome after LASIK surgery. LASIK surgery compares more favorably with other elective surgical procedures in terms of generally higher satisfaction rates.
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S. No	Author Name	Title	Years of Study and Place	Aim and Objectives	Methodol ogy	Result
4	Yvonne Tzu-Ying Wu, Arthu r Ho et. al	The risk of vision loss in contact lens wear and following LASIK	09 January 2020	To compare the risk of vision loss following contempor ary laser- assisted in situ keratomile usis (LASIK) with different types and modality of use of contact lenses	The prevalenc e of vision loss at six months post-surgery was captured from clinical trials published after 2003. A proportion meta-analysis was applied to derive the prevalenc e of vision loss following LASIK.	The risk of vision loss to the individual is low with either contact lens wear or refractive surgery. Contact lens wear does not pose a higher risk of vision loss than LASIK surgery for the most common wear modalities

5	Erich H.P. Brau n MD [1], Jane Lee MD [2], Roger F. Steinert MD	Research on monovision in LASIK and there purpose was to evaluate the preoperative characteristics and postoperative outcomes of presbyopic and pre-presbyopic patients	Departme nt of Ophthalm ology, University of California at Irvine, Irvine, California ,2008	To evaluate the preoperati ve characteri stics and postoperat ive outcomes of presbyopi c and prepresby opic patients selecting monovisio n correction by LASIK. Retrospect ive observatio nal case series	Patients treated with monovisio n correction by LASIK were measured and categorize d	Of 284 consecutivel y treated LASIK patients 45 years or older, 188 chose to be corrected for monovision and 96 chose bilateral distance correction. A majority of patients chose their dominant eye to be corrected for distance. Patients who selected their dominant eye for near vision correction had similar acceptance and refractive success rates.

METHODOLOGY

Research Approach

The primary goal of this study is to investigate the degree of visual improvement following LASIK surgery, both immediately (Post-Op Day 1) and at 1 month (Post-Op 1 Month), as well as to assess the residual refractive error (if any) after 1 month.

Research Design

This research utilizes a descriptive design to provide a comprehensive analysis of visual acuity changes post-LASIK surgery. The focus is on collecting observational data at two specific time points: immediately after surgery and one month post-operatively.

Sampling Technique

The study employed a cross-sectional sampling technique. The target population consisted of male and female patients with myopia and astigmatism who presented at the hospital for LASIK surgery. A total of 20 patients (10 males and 10 females) between the ages of 18 and 40 were selected for the study. A self-administered questionnaire was used to collect data regarding their post-operative visual outcomes.

Target Population

The target population included 20 adult participants aged 18 to 40 years. This group consisted of 10 females and 10 males, all diagnosed with myopia and/or astigmatism. All participants provided informed consent, and the study adhered to ethical standards in accordance with the Declaration of Helsinki.

Sample

A randomized sampling method was used to select participants who met the inclusion criteria for the study. The sample consisted of 20 patients, both male and female, with varying degrees of myopia and astigmatism, within the age range of 18 to 40 years.

Inclusion Criteria:

- Age between 18 and 40 years.
- Good general health, with no self-reported neurological illness.
- No history of significant ocular disease or injury.
- Normal binocular vision (no history of strabismus or ocular motility disorders).
- Astigmatism ranging from 0.50 DC to 5.00 DC to minimize the effects of habitual adaptation to uncorrected astigmatism.
- Best corrected visual acuity (BCVA) of 0.00 logMAR or 6/6 on the Snellen chart in both eyes.

Exclusion Criteria:

- Age above 40 years.
- Pseudophakic or aphakic patients.
- Visual acuity less than or equal to 6/9.
- Presence of any retinal or other significant ocular diseases.
- Individuals with physical or mental impairments.

Setting of the Study:

The study was conducted in a hospital vision clinic through face-to-face interactions. Observations were based on not only what the participants said or did but also how they carried out tasks. Non-verbal cues such

as body language and tone of voice were considered as critical factors in interpreting responses.

Description of the Tools:

- HEINE Retinoscope: Used to assess the refractive status of the eye.
- Auto Refractometer: Utilized to obtain an initial estimate of refractive error.
- Distance Vision Chart: Employed to measure visual acuity at a distance.
- Near Vision Chart: Used to assess near visual acuity.
- Trial Set: Used for subjective refraction testing to fine-tune prescriptions.

Validity of the Tools:
The instruments used in this study were validated for their intended purpose. All tools were functional and met the research setting's requirements.

Reliability of the Tools:
The tools used were reliable and adhered to research standards. They were fully operational and up to date, ensuring accurate and consistent results throughout the study.

Pilot Study:
Purpose: To assess the degree of vision improvement after LASIK surgery.
Method: Two astigmatic patients (ages 18-40) with spherical and cylindrical refractive errors were evaluated.
Results: Both patients exhibited distance visual acuity of 6/12 and reported symptoms such as eye watering, pain, and difficulty opening their eyes.

CONCLUSIONS

Post-surgery, the patients were unable to achieve 6/6 visual acuity on the Snellen chart (20/20 vision).

Plan of Analysis:
All participants underwent a thorough screening process to ensure they met the inclusion criteria. The following assessments were included in the vision screening:

1. Case History: Documentation of the patient's visual and medical history.
2. Refractive Error: Assessment of spherical and cylindrical errors.
3. Best Corrected Visual Acuity (BCVA): Measured for distance vision to achieve 6/6 or 20/20 vision with correction.
4. Aided and Unaided Distance Vision: Visual acuity was measured both with and without corrective lenses.

Challenges Faced by the Researcher:

1. Participants attempted to squint during the visual acuity test, affecting results.
2. Some participants were adjusting their position while reading the distance vision chart, moving closer or further away.
3. Participants tried to find "loopholes" to read the vision chart more easily.
4. Some participants were uncertain about the axis during the refraction assessment, affecting accuracy.

RESULTS

A total of 20 patients were observed following LASIK surgery using the Contura technique, with an equal distribution of 10 males and 10 females. The patients' ages ranged from 20 to 40 years, with a mean age of 25.7 years.

Pre-Surgery Visual Acuity (VA):

- Monocular VA (Unaided): Ranged from 4/60 to 6/12.
- Binocular VA (Unaided): 6/12.
- Aided Monocular VA: Ranged from 6/6 partial to 6/6.
- Aided Binocular VA: 6/6.

Objective Refraction:

- Spherical Power: ±0.50 to ±8.00 D (monocularly).
- Cylindrical Power: ±0.25 to ±6.00 D (monocularly).

Subjective Refraction:

- Spherical Power: ±0.25 to ±8.00 D (monocularly).
- Cylindrical Power: -0.25 to -5.00 D (monocularly).

Post-Surgery (Day 1):

- Patients with symptomatic complaints (watering, pain, difficulty opening eyes) had:
  - Monocular VA: Ranged from 6/24 to 6/18.
  - Binocular VA: 6/12.
  - These patients also experienced reduced contrast sensitivity.
- Patients who were asymptomatic had:
  - Monocular VA: Ranged from 6/12 to 6/6.
  - Binocular VA: 6/6.

Post-Surgery (1 Month):

- Monocular and Binocular VA: All patients, both symptomatic and asymptomatic, achieved 6/6 VA monocularly and binocularly.

Residual Refractive Error:

- Astigmatism: Approximately 0.50 D of against-the-rule (ATR) or oblique astigmatism remained.
- Spherical Power: Residual power ranged from ±0.25 to ±1.00 D.

Spherical Equivalent:

- The average spherical equivalent in the right eye was 2.73 diopters, and in the left eye, it was 2.64 diopters.

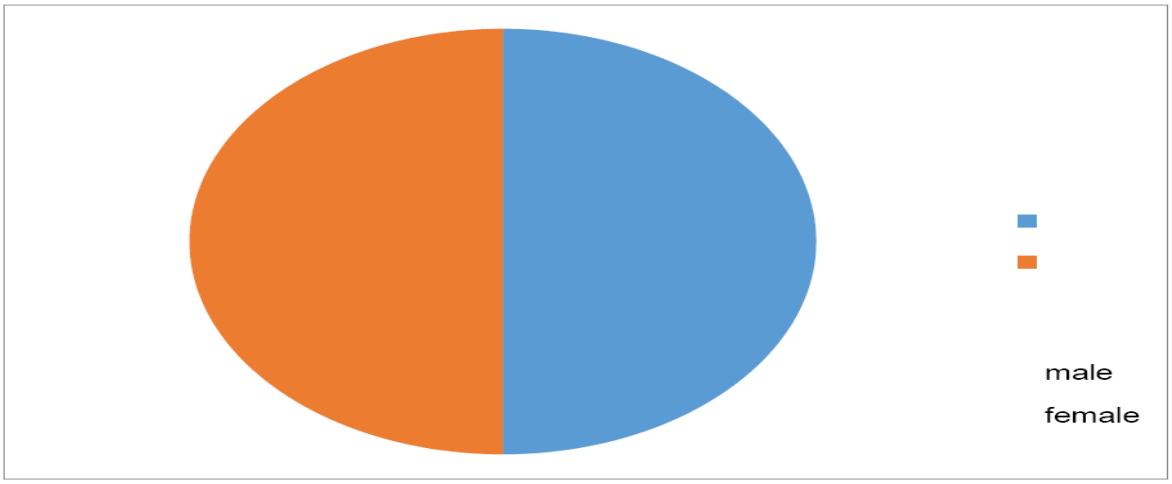

Figure.1: gender wise distribution of participants

	Mean	Standard Deviation
Pre-OP	0.9374605	0.281122
POP 1day	0.3225	0.1333155
POP 1month	0.0125	0.054486

Fig 2- Distribution of mean, Standard Deviation of Visual Acuity

A total patient of 20 patients, 10 were males and 10 females. The mean age of female participants was 23.3 and the mean age of male participants was 25.5.

The Pre-Operative mean value of visual acuity is 0.9374605.

The POP 1Day mean value of visual acuity is 0.3225.

The POP 1Month mean value of visual acuity is 0.0125.

The Pre-Operative of Standard Deviation of Visual Acuity is 0.281122. The POP 1-Day of Standard Deviation of Visual Acuity is 0.1333155. The POP 1-Month of Standard Deviation of Visual Acuity is 0.054486.

1- Distribution of Pre-Op UCVA

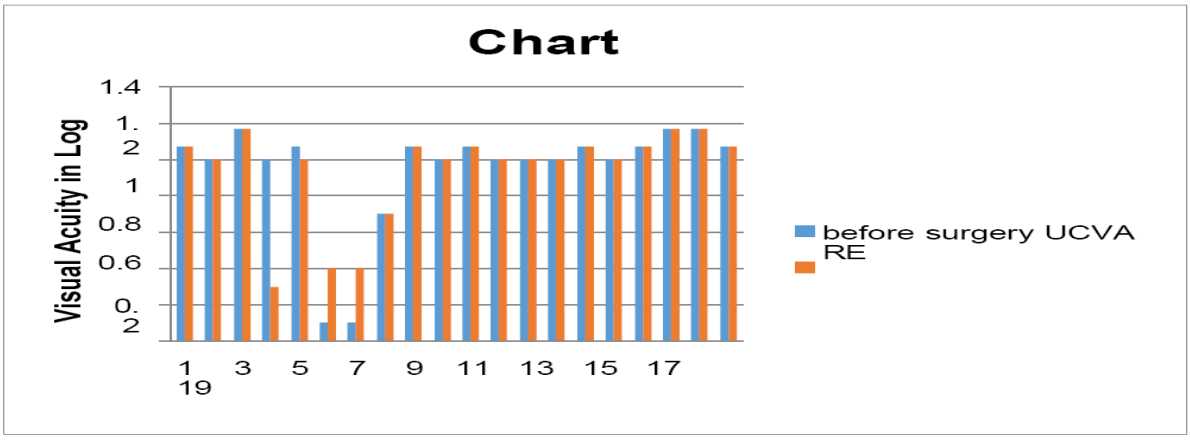

Fig-4 Distribution of Visual Acuity

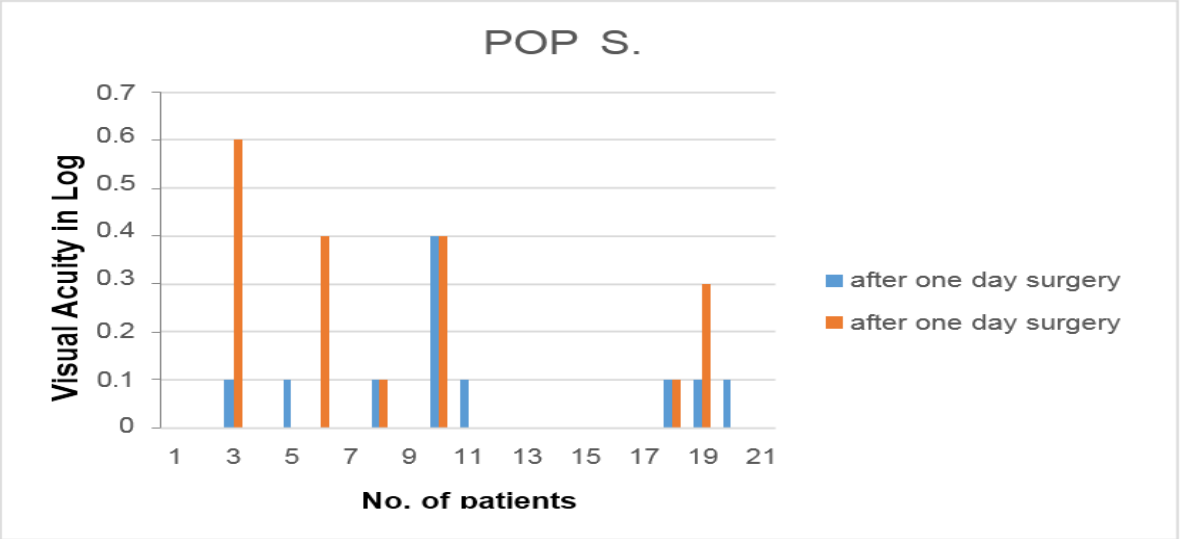

Fig 5- Distribution of Visual Acuity after 1 Month

After the observation of 20 patients of POP 1 months were observed that out of 40 eyes 38 eyes visual acuity was 6/6 in Snellen's Chart, 1 patient's left eye visual acuity was 0.1 and one patient's right eye visual acuity was 0.4.

DISCUSSION

With advancements in refractive surgery techniques, both patients and medical practitioners have raised questions regarding the comparative safety and efficacy of different vision correction methods, especially in terms of visual outcomes and post-operative recovery.

Previous studies have reported that patients often experience night vision disturbances and reduced contrast sensitivity after LASIK surgery, with a recovery period of 6 to 12 months needed to restore full contrast sensitivity. Additionally, patients with larger pupils have been associated with early post-operative visual quality issues, such as glare and halos. However, no clear correlation was found in these early stages of recovery.

In our study, we observed that patients achieved near-complete restoration of visual acuity (monocularly and binocularly) much earlier, typically within 1 week to 1 month after surgery. Contrary to earlier research findings, by the end of the first month, none of our patients reported issues with night vision or glare, and all demonstrated 6/6 visual acuity on the Snellen chart. This suggests that while contrast sensitivity recovery can take longer in some cases, the visual acuity improves rapidly, and major symptoms subside much earlier in most cases.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that while visual acuity is reduced immediately after LASIK surgery, it typically takes about 1 week to 1 month for patients to achieve optimal visual acuity. Different types of refractive surgeries show varying post-operative responses, with advanced surface ablation (ASA) taking up to a month for full recovery, while patients who underwent femtosecond (FS) LASIK regained their vision more quickly and experienced fewer symptoms.

We observed that patients who were symptomatic post-surgery (experiencing pain, watering, and difficulty opening their eyes) had visual acuity ranging from 6/24 to 6/12 both monocularly and binocularly on post-op day 1. However, those without symptoms had better initial vision, ranging from 6/12 to 6/6. By the one-month follow-up, all patients achieved 6/6 visual acuity monocularly and binocularly.

Our hypothesis, that patients would achieve 6/6 vision by post-op day 1, was not fully supported. Instead, patients showed a wide range of vision on day 1, with full visual acuity only achieved by the one-month mark.

Recommendations:

- Future research should further explore the relationship between pupil size, contrast sensitivity, and night vision disturbances post-surgery.
- Follow-up periods should be extended beyond one month to evaluate long-term visual quality, particularly contrast sensitivity and night vision.

- Different surgical techniques should be compared in larger, randomized trials to determine which method offers the quickest recovery with minimal symptoms.

Summary

This research aimed to evaluate the visual acuity of LASIK patients both monocularly and binocularly at two post-operative stages: post-op day 1 and post-op 1 month. We used a variety of tools, including vision charts, an auto-refractometer, retinoscope, topography, biometry, Pentacam, and wavefront analysis, to assess visual acuity, refraction, and corneal curvature.

Twenty randomly selected patients, aged 18 to 40 years, with myopia and astigmatism, were included in the study. These patients were observed before surgery and at both post-op stages to assess their visual acuity. Pre-surgery, their monocular unaided vision ranged from 4/60 to 6/12, and their aided vision ranged from 6/6p to 6/6. Post-surgery, symptomatic patients showed reduced vision (6/24 to 6/18 monocularly and 6/12 binocularly), while asymptomatic patients had better outcomes (6/12 to 6/6 monocularly and 6/6 binocularly). By the one-month follow-up, all patients achieved 6/6 vision monocularly and binocularly.

The study confirms that while immediate post-surgical symptoms and vision disturbances are common, patients can expect full recovery within a month, achieving optimal visual acuity without significant long-term complications.

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