LIMBAL RELAXING INCISIONS VERSUS PENETRATING LIMBAL RELAXING INCISIONS FOR THE MANAGEMENT OF ASTIGMATISM IN CATARACT SURGERY

A Thesis Submitted For Partial Fulfillment
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تقييم الشق الاسترخائى للقرنية لعلاج اللانقطية أثناء جراحة المياه البيضاء

رسالة مقدمة توطئة للحصول على درجة الماجستير
فى طب و جراحة العيون

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مقارنة بين الجرح الإسترخائى لأطراف القرنية و الجرح الإسترخائى المخترق لأطراف القرنية فى علاج اللانقطية مع جراحات المياة البيضاء

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Abstract

Purpose:
This study was designed to compare between Limbal relaxing incisions and Penetrating limbal relaxing incisions in the management of astigmatism during cataract surgery.

Design: Prospective, comparative, non-randomized case series.

Setting: Cairo university hospitals (Kasr EL-Aini; Ophthalmic surgical department)

Patients and methods:
Our study was divided into two groups, group A; 20 eyes of 20 cases LRIs and group B; 20 eyes of 20 cases PLRIs. Limbal relaxing incisions entail performing one or two limbal incisions along the steepest meridian with a depth of 450-600μ using a preset blade set at the required depth. Penetrating limbal relaxing incisions entail performing two full thickness incisions using a keratome knife along the steepest meridian, in addition to the clear corneal stab incision of the phacoemulsification.

The main outcome measures include: UCVA, BCVA, and manifest refraction. Corneal topography was done for all patients at 1 week postoperative.

Results: At 1 week postoperative, the average change in corneal cylinder (Δchange) was found to be 1.178 D, SD 0.338 in the LRI group and -0.095 D, SD 0.846 in the PLRI group.

Conclusion: The use of LRIs has been shown to be extremely safe and reliable. In the setting of concomitant lens surgery, our data indicate that this technique provides for more predictable astigmatic outcomes as compared to the use of PLRIs, and yields more consistent results than when relying solely upon a tailored phaco incision

.

Key words: LRIs, PLRIs, Astigmatism, Corneal topography

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List of abbreviations

AK: Astigmatic keratotomy

BCVA: Best corrected visual acuity

CCIs: Clear corneal incisions

CRIs: Corneal relaxing incisions

D: Diopters

IOL: Intraocular lens

IOP: Intra-ocular pressure

k-readings: Keratometry readings

LASIK: Laser In situ Keratomilueusis

LRIs: Limbal relaxing incisions

mm: Millimeters

OAIs: On-axis incisions

PERK: Prospective evaluation of radial keratotomy

PLRIs: Penetrating limbal relaxing incisions

PRK: Photorefractive keratoplasty

RK: Radial keratotomy

SIA: Surgically induced astigmatism

SD: Standard deviation

UCVA: Uncorrected visual acuity

µm: Micro meters

V: Version

V / H: Vertical / Horizontal

∆: Delta

INTRODUCTION AND AIM OF WORK

Aim of work

The aim of this study is to compare between limbal relaxing incisions (LRIs technique) and penetrating limbal relaxing incisions (PLRIs technique) as regards the simplicity and efficacy in the treatment of preexisting corneal astigmatism at the time of cataract surgery.

Astigmatism

Astigmatism is an optical defect whereby vision is blurred due to inability of the optics of the eye to focus a point object into a sharp focused image on the retina. This may be due to an irregular or toric curvature of the cornea or lens.

The cornea with astigmatism may be thought of being shaped like an American football rather than being shaped like a basketball.

The refractive error of the astigmatic eye stems from a difference in degree of curvature of the two different meridians (i.e. the eye has different focal points in different planes.). Astigmatism causes difficulties in seeing fine detail, and in some cases vertical lines may appear to the patient to be tilted.

TYPES:

Based on axis of the principal meridians

1. Regular astigmatism: principal meridians are perpendicular
    - With-the-rule astigmatism: the vertical meridian is steepest
    - Against-the-rule astigmatism: the horizontal meridian is steepest
    - Oblique astigmatism: the steepest curve lies in between 120 and 150 degrees and 30 and 60 degrees

2. Irregular astigmatism: principal meridians are not perpendicular

Based on focus of the principal meridians

1. Simple astigmatism
    - Simple hyperopic astigmatism: first focal line coincides with the retina while the second is located behind the retina
    - Simple myopic astigmatism: first focal line is located in front of the retina while the second focal line is located on the retina
2. Compound astigmatism
    - Compound hyperopic: both focal lines are located behind the retina
    - Compound myopic: both focal lines are located in front of the retina
3. Mixed astigmatism: focal lines are on both sides of the retina

In a Montes-Mico study to evaluate the prevalence of astigmatism in infancy and childhood, the overall prevalence of astigmatism (≥1.00 D of cylinder) decreased in relation to increasing age (2-12 years), from 44.3% to 5.2%. **(3)**

There are a number of tests used by ophthalmologists and optometrists during eye examinations to determine the presence of astigmatism and to quantify the amount and axis of astigmatism. A snellen chart or other eye charts may initially reveal reduced visual acuity. Autorefractometry or retinoscopy may provide an objective estimate of the eyes refractive error and the use of Jackson cross cylinder may be used to subjectively refine those measurements.

There are also a number of instruments used to measure the corneal surface, detect the presence of astigmatism and its axis. They include: keratometer, keratoscope, placido based corneal topography and slit scanning such as the Orbscan and recently the scheimpflug camera commercially available under the name of Pentacam.

Instruments to measure the corneal surface

Keratometer

Keratometry passed through different phases along the years. From the placido disc which aimed at studying the first Purkinjie Sanson image reflected from the anterior corneal surface to the early keratometer invented by Helmholtz in 1854. This keratometer measures the distance between two pairs of image points that have been reflected from the corneal surface. It uses a standard object size and according to the distance between the reflected images, which is represented by the edges of two circles that are made to touch each other. Then came the Javal-Schiotz model which was preferred by many ophthalmologists due to the ease of its use. It applied the same principle as the Helmholtz prototype but instead it used a variable object size to measure the corneal curvature for a fixed image i.e., the size of the object shadowed on the surface of the cornea was varied until it produced an image of certain standard size (the alignment of the mires). The Javal-Schiotz keratometer used Walstrom prisms to split light emerging from the cornea and duplicate the image to facilitate its use. **(42)**

Keratometers, although easy to use and economically convenient, have many limitations. They can assess only a central area of the cornea ranging from 2.88 mm for a 50 diopters steep cornea to a 4.0 mm diameter area for a cornea with a 36 diopters power. They not only fall short of measuring the cornea outside this circle to give the examiner a comprehensive view of the corneal surface and peripheral asphericity, but also fall short of measuring the corneal curvature inside this circle as well. The keratometer estimates the central corneal curvature by evaluating four points on the circumference of the central 3.0 mm circle, then estimates mathematically and indirectly the curvature of the cornea inside that circle. This applies very well when the cornea is regular and uniform in central curvature. If there is any element of irregular astigmatism only central to the annulus around which it takes the reading, the keratometer will not detect it. As the central corneal surface area is very important to examine in candidates of refractive corneal surgery, the keratometer offers little help in the evaluation of these patients. **(43)**

A keratometer quantitatively measures the radius of curvature of different corneal zones of 3 mm diameter. The present day keratometer allows the operator to precisely measure the size of the reflected image, converting the image size to corneal radius using a mathematical relation $r=2a\ Y/y$, where r: anterior corneal radius, a: distance from mire to cornea (75 mm in keratometer), Y: image size, y:mire size (64 mm in keratometer). The keratometer can convert from corneal radius r (measured in meters) into refracting power RP measured in (diopters) using the relationship: $RP=337.5/r$. Modern keratometers directly convert from radius into diopters and inversely.

<u>Corneal topographers</u>

Corneal topography, also known as photokeratoscopy or videokeratography, is a non-invasive medical imaging technique for mapping the surface curvature of the cornea, the outer structure of the eye. Since the cornea is normally responsible for 70% of the eye's refractive power, **(38)** its topology is of critical importance in determining the quality of vision.

The three-dimensional map is therefore a valuable aid to the examining ophthalmologist or optometrist and can assist in the diagnosis and treatment of a number of conditions; in planning refractive surgery such as LASIK and evaluation of its results; or in assessing the fit of contact lense. A development of keratoscopy, corneal topography extends the measurement range from the four points a few millimeters apart that is offered by