Role of Refractive Surgery in Treatment of Keratoconus

Essay Submitted for Partial Fulfillment
of Master Degree in Ophthalmology

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دور جراحات الإنكسار الضوئى فى علاج القرنية المخروطية

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نشوى محمد عزات

بكالوريوس الطب والجراحة

توطئة للحصول على درجة الماجستير
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تحت إشراف

الأستاذ الدكتور / ميرفت صلاح

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Introduction

Keratoconus is a non inflammatory, progressive, bilateral thinning disease of the cornea. It is characterized by the development of a corresponding protrusion with an apex often located centrally or in an inferior eccentric position. The treatment of keratoconus depends on the severity of the disease.

In the disease's early stages, spectacles and contact lenses are the usual treatment modalities. In more advanced cases, with severe corneal irregular astigmatism and stromal opacities, contact lenses may no longer improve the visual acuity and a penetrating keratoplasty (PKP) is necessary to restore the visual function ***(Kang et al, 2005)***.

In some cases, however, the cornea is still transparent but the patient is contact lens intolerant. In such young, often allergic patients, the patient and the surgeon are often reluctant to pursue the PKP option ***(Brierly et al, 2000)***.

Currently, surgical options for correcting keratoconus can be classified into:

1. **Procedures that change the cornea**: lamellar keratoplasty and penetrating keratoplasty.
2. **Procedures that reinforce the cornea**: epikeratoplasty and intrastromal corneal ring segments (Intacs).
3. **Procedures that do not touch the cornea**: phakic intraocular lens (IOL).
4. **Procedures that weaken the cornea**: photorefractive keratectomy (PRK) and laser insitu keratomelusis (LASIK). ***(Colin and Velou, 2002)***.

Incisional Techniques such as radial and astigmatic keratectomies have limited applicability because of unpredictable efficacy, excessive instability and fragility of the cornea ***(Colin and Velou, 2002)***.

Procedures that change the cornea

Penetrating keratoplasty for keratoconus provides good visual results in most cases. However, visual rehabilitation is slow, there is a constant endothelial cell loss, and a risk of graft rejection ***(Brierly et al, 2000)***.

Deep lamellar keroplasty can be used to try to decrease the incidence of some of the complications of PKP ***(Shimmura et al, 2005)***.

Procedures that reinforce the cornea

For the treatment of keratoconus, it is far more logical to reinforce the cornea using additive technology, compared to weakening the structural integrity of the cornea using ablative or incisional procedures**.**

Epikeratoplasty aims at flattening the ectatic cornea and supporting the bulged corneal dome by adding healthy donor tissue. Progression of keratoconus may be arrested. If unsuccessful, the procedure could be complemented and there was no interference with a later PKP ***(Wagoner et al, 2001)***.

Intracorneal rings were first used for the correction of low myopia. They act as passive spacing elements that shorten the arc length of the anterior corneal surface and therefore flatten the central cornea.

The goal of using Intacs inserts for treating keratoconus is not to eliminate the corneal disease but to decrease corneal abnormality associated with it and improve visual acuity in affected patients to satisfactory levels ***(Colin and Simonpoli, 2003)***.

Procedures that do not touch the cornea

Phakic refractive IOLs are gaining more and more popularity due to ease of implantation and the predictability of refractive and visual results. Implantation of refractive IOL may be considered to avoid any corneal postoperative fragilization. Moreover, the anterior chamber depth is usually over 3.0 mm ***(Budo et al, 2005)***.

Procedures that weaken the cornea

Excimer laser photoablation has been used in keratoconus for two main purposes; first, as a therapeutic superficial keratectomy to treat patients with contact lens intolerance caused by a 'proud nebulae' and as a refractive procedure to flatten the cone and reduce high astigmatism enabling patients to regain relatively useful vision and conduct daily activities with or without spectacles or contact lenses, postponing the need for PKP ***(Lahners et al, 2001)***.

LASIK has been used to treat myopic astigmatism in patients with keratoconus. The initial visual results appeared promising, but longer follow up revealed regression of the refractive outcome in some cases. Excessive thinning of the stromal bed together with the action of the intraocular pressure may cause a progressive keratectasia manifesting months after the LASIK procedure ***(Vinciguerra and Camasasca, 2001)***.

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Aim of the Work

The purpose of this study is to review the recent literatures concerning various procedures of refractive surgery used in treatment of keratoconus.

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List of Abbreviations

µm	Micrometer
AA	Analysis area
ALK	Automated lamellar keratoplasty
ArF	Argon fluride
BM	Bowman's layer
BSC VA	Best corrected visual acuity
BSS	Balanced salt solution
C3-R	Corneal collagen cross-linking riboflavin
CK	Conductive keratoplasty
CLEK	Collaborative longitudinal evaluation of keratoconus
cm	Centimeters
CSI	Center/surround index
D	Diopters
DALK	Deep anterior lamellar keratoplasty
DK	Diffusion constant
DM	Descemet's membrane
DSI	Differential sector index
EBM	Epithelial basement membrane
E-value	Eccentricity value
FDA	Food and drug administration
FS	Femtosecond
IAI	Irregular astigmatism index
ICR	Intra corneal ring
INTACS	Intracorneal ring segments
IOL	Intra ocular lens

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