

RADIAL KERATOTOMY: EFFECTS OF CORNEAL THICKNESS ON FINAL OUTCOME

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Background: Corneal thickness may contribute in the final outcome of radial keratotomy operation for the correction of myopia. We present our study on ninety-nine consecutive eyes with a mean follow-up of one year. **Methods:** Ninety-nine eyes with preoperative/uncorrected Myopia between 2.5–6.0D and a mean age of 29.2 (± 7) years underwent radial keratotomy between January 1999–December 2001 in the Department of Ophthalmology, Military Hospital, Rawalpindi. The eyes were divided based on their corneal thickness into group-A (51 eyes), with a pachymeter reading of 500–540 μm , and Group-B (48 eyes), with a pachymeter reading of 541–580 μm . The comparison between the Postoperative visual acuity of two groups was made at the end of study after one years` follow up. **Results:** Forty-five eyes (88.23%) in Group-A improved to an uncorrected acuity of 20/20 as compared to forty eyes (83.33%) in Group-B ($p > 0.05$). Hyperopic shift occurred in two eyes (3.92%) in Group-A, as compared to ten eyes (20.83%) of Group-B ($p > 0.05$). Refraction showed that 94.11% cases of Group-A to be within 1 diopter of Emmetropia as compared to 93.75% cases in Group-B. Similarly, 98.03% cases of Group-A were within 2 diopters of Emmetropia as compared to 95.83% cases of Group-B. Glare and variation of vision in the initial four weeks were the most frequently reported complications in both groups. **Conclusion:** Thickness of cornea does not significantly affect the outcome of surgery in cases of low to moderate degrees of myopia.

KEYWORDS: Radial Keratotomy, Corneal Thickness, Myopia

INTRODUCTION

Radial keratotomy (RK) is a widely accepted surgical procedure to correct myopia. In the operation, sets of 4-12 evenly spaced radial incisions are made in the treated cornea, which extend from the boundary of a central optical clear zone of specified diameter to the outer periphery of the cornea¹.

The intraocular pressure causes the weakened peripheral region of the cornea to bulge outward and flatten the central visual region by stretching it like a drumhead. The central flattening reduces the refractive power of the anterior corneal surface, and the focal point is shifted posteriorly to the surface of the retina producing corneal flattening after the operation².

The effectiveness of this procedure depends on the surgeon's ability to select surgical variables that lead to the desired reduction in the refractive power³. Many preoperative and postoperative variables affect the outcome of the surgery such as refractive state of the patient, axial length of the cornea, age of the patient, or systemic disease, depth of incision, as well as extension of the incision³⁻⁵ etc. So far, no local study has been documented regarding the effect of corneal thickness on results of surgery.

We conducted our study to find out the effect of corneal thickness on results of radial keratotomy.

MATERIAL AND METHODS

The study was conducted in the Department of Ophthalmology, Military Hospital, Rawalpindi from Jan 1999 to Dec 2001. Ninety-nine cases were included in the study. The subjects were between 21–40 years of age, had stable preop refraction for at least two consecutive years, myopia between 2–6 Diopters, and corneal pachymetry between 500–580 μm . Patients with history of Diabetes, Collagen vascular disorders, ocular trauma or previous eye surgery, examination finding of a conjunctival, corneal or lenticular pathology, having eyes with high IOP, or irregular astigmatism were excluded from the study. Blood complete picture, ESR, fasting blood glucose were done to rule out associated diseases.

All cases were examined thoroughly under slit lamp and cycloplegic refraction was done to confirm the findings and correction required. Preoperative thirty-spot screening Pachymetry was done and the central corneal thickness was taken as the standard for the study. All of these cases underwent an eight-incision radial keratotomy by a single surgeon (author) using the combined approach, with a double edged diamond Knife (Duckworth and Kent), done as an out door procedure.

Preoperatively 0.5% Proparacaine eye drops were used for the local anaesthesia. Intraoperative corneal pachymetry was done at 1.5 mm from the visual center, at the 3 mm central clear zone, and calibration and adjustment of Diamond knife was done accordingly. After applying the selected radial marker for several seconds, the knife was entered at the central corneal margin and a centrifugal radial incision was initiated, penetrating about 90–95% of corneal stroma, making a cut to 1 mm within the limbus. This procedure was repeated so that eight incisions were made.

Postoperatively the eyes were padded and Tab. Diclofenac Sodium six hourly, was given for pain. They were then seen on the following day and advised 0.1% Dexamethasone drops six hourly for the first week and then eight hourly for one week.

Follow-up was done at six weeks, two months, four months, sixth months and finally at one year of surgery. On the basis of pachymetry, the subjects were then divided into two groups. Group A comprised of fifty-one cases with a corneal pachymetry of 510–540 μm , whereas Group-B consisted of forty-eight cases with pachymetry of 541–580 μm . In each follow-up, the unaided visual acuity, hyperopic shift, under or overcorrection was noted by cycloplegic refraction with 1% Cyclopentolate eye drops.

Questions were specifically asked about the presence of glare, fluctuation of vision during the day, pain or photophobia and corneal examination was done to look for any signs of infection or wound gap. The significance of difference between the two groups regarding final unaided visual acuity and degree of hyperopic shift was determined at the end of study with χ^2 test.

RESULTS

The mean age of the patients was 29.2 (± 7) years. Results of investigations are shown in Table-1.

Table-1: Mean results of investigations (n=99)

Tests (SI Units)	Mean Results
Blood ESR (mm fall at 1 hour)	12 \pm 10 mm fall
Blood Glucose Fasting (mmoles/l)	4.8 \pm 3.0 mmole/l
Blood Complete Picture	Within Normal Range in 87% High Total Leucocytes in 08% Low Platelet Count in 05%

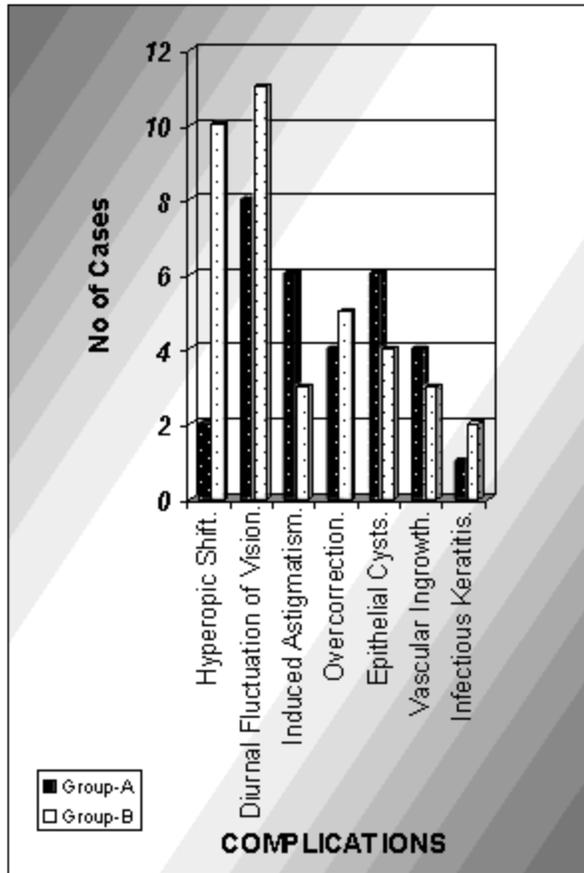
The mean follow up time was twelve months. Forty-five eyes (88.23%) of Group-A attained a final unaided vision of 20/20 in the operated eye, whereas this vision was achieved in forty eyes (83.33%) of Group-B ($p > 0.05$). Refraction showed that 94.11% cases of Group-A to be within 1 diopter of Emmetropia as compared to 93.75% cases in Group-B. Similarly, 98.03% cases of Group-A were within 2 diopters of Emmetropia as compared to 95.83% cases of Group-B. These results are summarized in the Table-2.

Table-2: Comparative results at the end of study (n=99)

Groups (Corneal Thickness)	Unaided Visual Acuity		Spectacle Correction		Hyperopic Shift	
	20/20 (6/6)	20/25 (6/9) or Worse	Within 1D Of Emmetropia	Within 2D Of Emmetropia	Present	Absent
A=51 (510–540)	45	6	48	50	2	49
B=48 (541–580)	40	8	45	46	10	38

Complications of the procedure were few and did not adversely affect the visual outcome of any case. The most common was glare especially at night, seen in eighteen eyes (18.18%) that gradually cleared itself with the passage of time. Hyperopic shift occurred in two cases of Group-A (3.92%), as compared to ten cases (20.83 %) of Group-B ($p > 0.05$). The frequency of complications is given in Figure-1.

Figure-1: Frequency of complications after surgery (n=99)



DISCUSSION

Modern radial keratotomy technique is based on multiple radial incisions of 85%–95% stromal depth that terminate 1 mm or more inside the limbus⁶. It was adapted for use by the ophthalmic professional community in 1978⁷⁻⁹, and the multicentre, PERK study (Prospective evaluation of Radial Keratotomy) done over a ten-year period in USA has contributed much to the current understanding of the predictability and stability of the refractive result after radial keratotomy¹⁰. It is a safe and effective method to correct low myopia up to -6.00 diopters (D)¹¹, the technique offers various advantages: clinical experience of more than 15 years, fast visual rehabilitation, minimal discomfort postoperatively, and low cost and technical requirements¹²⁻¹⁶. Nevertheless, the final refractive outcome could be variable from individual to individual due to difference in response to injury among the population, resulting in over corrections and under corrections in a certain percentage of patients¹⁷. Possible complications include glare and fluctuation of vision¹⁸, hyperopic shift, infectious keratitis, and endophthalmitis¹⁹. It neither weakens nor causes increased susceptibility of cornea to trauma than a normal eye²⁰. The role of corneal thickness in the results of radial keratotomy was not mentioned earlier in the literature. We undertook our study with the same aim. Ninety-nine cases with low to moderate degrees of myopia (-1.5 to -6.0 D) were included in the study. The results were evaluated by comparing a patient's refractive error and uncorrected vision before and after surgery. A comparison between our results and studies done abroad is given Table-3.

As shown in the results, the outcome of surgery between the two groups was not statistically significant. Regarding the complications of the procedure, when asked directly, all patients were satisfied with the result of their operation in general; eighteen patients complained of glare that gradually subsided with the passage of time. Patient satisfaction was high and 78% of the patients elected to undergo radial keratotomy in their fellow eye.

Table-3: A comparison of various studies on radial keratotomy

Study	PERK study²¹	Arrowsmith and Marks²²	Deitz and Sanders^{23,24}	Our study
Year of surgery	1982-83	1980-81	1982-85	1999-2001
Follow up time	3 years	5 years	1 year	1 year
No of eyes	435	122	972	99
No of incisions	8-16	8	8-16	8
Knife Blade	Diamond (single edge)	Steel	Diamond (double edged)	Diamond (double edged)
Central clear cornea	3.0-4.0 mm	3.0-5.0 mm	2.7-6.0 mm	3.0
Over-corrected 1.0D	16%	33%	12%	9%
Under- corrected 1.0 D	18%	13%	12%	10%
Uncorrected VA>6/12	76%	76%	88%	98%

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