New Formula to Calculate the Size of the Corneal Flap for Autologous Ipsilateral Rotational Keratoplasty

Prof.(Dr.) Bijay Kumar Parida (MBBS,LLB,MS,ICO,FRCSG)[1], Ms.Anannya Anupurva[2]

[1]Associate Professor, Muthusamy Virtual University of Ophthalmology Post Graduation, Bhubaneswar, Odisha, India

[2]3rd year student, MVJ Medical College, Bangalore

Abstract— *A new formula for autologous ipsilateral rotational keratoplasty has been designed and verified by surgical procedure on 19 eyes. The formula is found to be successful in all cases. The diameter (D) of the cornea to be rotated is equal to the length of scar from one side of pupillary margin in semidark room, nearest to the scar to the farthest end of the scar (L) nearest to center of pupil, added to the pupillary diameter (Pd) in semidarkness. The direction of rotation of scar is just opposite of radius under consideration and off center by 0.5mm (trephine is put on 0.5mm outside the pupillary margin.*

D=L+Pd

Minimum clear cornea required for rotational flap is 4 mm on one side of the pupil. In eyes with eccentric corneal opacities partially involving the pupillary area, using a rotational corneal autograft, can revitalise vision. This procedure does not warrant immunological rejection associated with allografts.

Keywords— rotational autograft, cornea, formula.

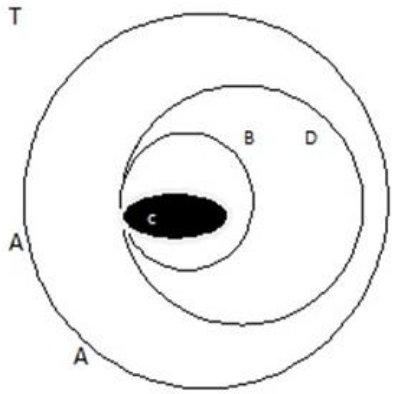
I. INTRODUCTION

Many erudite authors have prescribed formulae for this purpose. But two of them shall be discussed in the chapter for discussion, as it is commonly used. Formula have been described that help assess the suitability of the procedure and choose the size of the trephine to be used. The use of digital photographs and imaging software to assess the suitability of the procedure has also been described by other learned authors[1,2,3]. This is a procedure that works best in eyes that have a central corneal opacity and clear peripheral cornea. An eccentric trephination is performed that allows the removal of disk of cornea containing the central opacity.

Various methods have been described for these calculation[4,5].

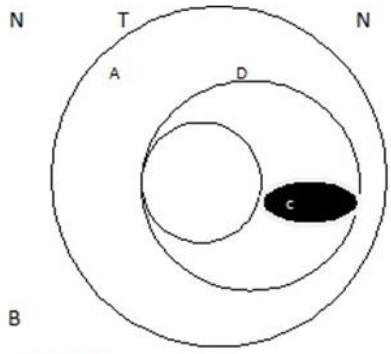
II. MATERIAL & METHOD

19 cases were operated having corneal scar involving either entire pupil or a part of the pupil. The scars were of variable thickness, either involving entire thickness of the cornea or partial thickness of cornea. The age of the patients ranged from 10 years to 44 years. The formula mentioned above was followed to use size of the trephine.



A . Cornea of size = 12mm in diameter.
B. Pupil size of diameter =4mm
C. Scar involving 3mm of temporal side of pupil
D. Planned rotation of flap=3mm+4mm=7mm in diameter.
T. Temporal side
N. Nasal side

FIGURE 1A: LEGENDS (MONO IMAGES)



After rotation of corneal flap

A . Cornea of size = 12mm in diameter.

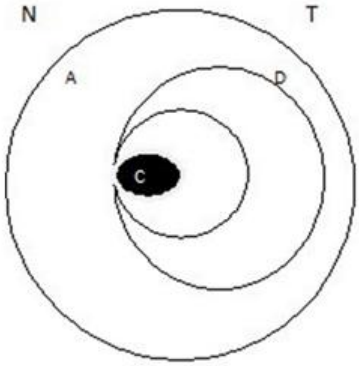
B. Pupil size of diameter = 4mm

C. Scar is out of pupil and driven to temporal side

D. Planned rotation of flap=3mm+4mm=7mm in diameter.

T. Temporal side

N. Nasal side



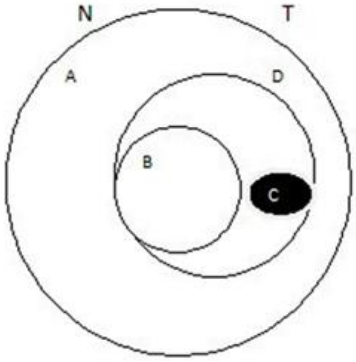
A . Cornea of size = 12mm in diameter.

B. Pupil size of diameter =4mm

C. Scar involving 2mm of temporal side of pupil

D. Planned rotation of flap=2mm+4mm=6mm.

FIGURE 2A



After rotation of corneal flap

A . Cornea of size = 12mm in diameter.

B. Pupil size of diameter =4mm

C. Scar is out of pupil and driven to temporal side

D. Planned rotation of flap=2mm+4mm=6mm.

FIGURE 2B

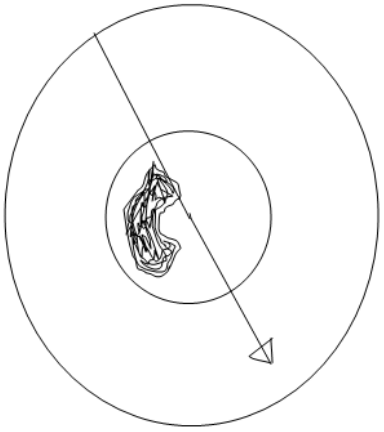


FIGURE 3A: ROTATION OF FLAP
SHADED AREA IS THE SCAR BEFORE ROTATION

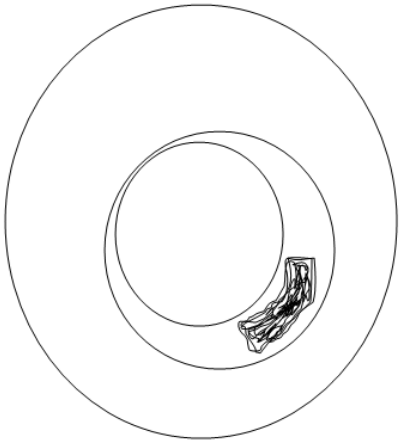


FIGURE 3B: AFTER ROTATION, POSITION OF SCAR

Suturing was done first by smooth apposition of epithelium at 4 points. Then the needle grazes over either descemet's membrane or stroma demanding on thickness of cornea to continue smooth apposition of epithelium.

Follow ups after 1 month and 6 months were done to evaluate visual acuity and endothelial count by specular microscope at graft junction and other parts of rotated cornea were done. In average postoperative visual acuity was 6/12 and endothelial count was satisfactory. Night glare was absent in all cases.

It was concluded that this formula to select the size trephine was satisfactory.

III. DISCUSSION

Formula proposed by Dr Jonas is ¾ diameter of the cornea-1/2 e(preoperative distance between the corneal center and nearest edge of the opacity to the center)[1].

Example- figure 1 if cornea diameter is 12 mm, then ¾ × 12= 9mm.

Scar size 3mm (2 mm on nasal side and 1 mm on temporal side of center of pupil).

Then ½ of 1mm=1/2mm

9-1/2=17/2=8.5mm

*Applying proposed formula designed by Dr Bijay,3mm+4mm=7mm flap of cornea needs to be rotated starting from nasal side of the cornea. Thus it is found that flap size is 1.5 mm less than the flap size required by the formula designed by Dr Jonas. Larger flap leads to closeness to limbus. This may initiate rejection of cornea and invasion of blood vessels into cornea. "A rotational autograft can be an effective alternative to standard penetrating keratoplasty for some patients with corneal scars. We establish a mathematical model for most clinical instances of a rotational autograft, in which an 8-mm graft with a decentration of 0.5 mm best satisfies the goals of surgery. Studies assure that the endothelial loss due to such procedure is less in comparison to homologous penetrating keratoplasty[6].

It means that 8mm of diamter of graft is used in all cases.

*By formula of Dr. Bijay, only 7mm of diameter of cornea is rotated.

Autokeratoplasty using the contra lateral eye has been used relatively infrequently because the set of circumstances that indicate this procedure are rare (i.e, the patient must have a nonfunctioning control at real eye with a clear cornea)[7-10].

Several authors have suggested the use of different geometric shapes for the ipsilateral autokeratoplasty, such as a triangle [11-13], a rectangle[14] or a figure eight[11-13] ; how-ever, none have replaced the standard circular graft with an eccentric center[17-21]. In this form of penetrating keratoplasty, the area of clear cornea is placed in the geometric center of the cornea and the opacity is rotated toward the limbus. The objective is to achieve the largest possible optically clear zone.

IV. CONCLUSION

The new formula for autologous ipsilateral rotational keratoplasty is shown below

D=L+Pd

Which is very simple and verified by surgical procedure on 19 eyes.

It is expected to give successful result with suturing at differential thickness of cornea as thickness of new alignment is not equal.

REFERENCES

[1] Bourne WM, Brubaker RF. A method for ipsilat-eral rotational autokeratoplasty.Ophthalmology.1978;85:1312-1316

[2] Karpouzas I, Pouliquen YJ-M. Computerized method for rotational autokeratoplasty.Cornea.1991;10:369-371.

[3] Jonas JB,Panda-Jonas S.Calculation of size and location of autologous ipsilateral rotating keratoplasty.Graefe's Arch Clin Exp Ophthalmol .1994;232:538-544

[4] Bourne WM,Brubaker RF,A method of ipsilateral rotational autokeratoplasty.Ophthalmology. 1978;85:1312-1316

[5] McDonnell pj,Falcon MG.Rotational autokeratoplasty.Eye. 1989;3:576-580

[6] Optimal Size and Locationfor Corneal Rotational AutograftsA Simplified Mathematical Model Natalie A. Afshari,et al .Arch Ophthalmol, / VOL 124, MAR 2006.p410-413

[7] Gundersen T, Calnan AF. Corneal autografts, ipsilateral and contralateral.Arch Ophthalmol. 1965;73:164-168.

[8] Stocker FW. Rotating autokeratoplasty. SouthMedJ. 1969;62:1183-1184.

[9] Boruchoff SA, Dohlman CH. Corneal autografts.Am J Ophthalmol. 1967;63:1677-1681.

[10] Groden LR, Arentsen JJ. Ipsilateral rotatingautokeratoplasty.Ann Ophthalmol 1982;15:899-901.

[11] Forster A. A review of keratoplastic surgery and Some experiments in keratoplasty.Am JOphthalmol. 1923;6:366-375.

[12] McDonnell PJ, Falcon MG. Rotationalautokeratoplasty.Eye. 1989;3:576-580.

[13] Mortada A. Rectangular autogenous penetratingkeratoplasty.Am J Ophthalmol 1965;59:795-799.

[14] Wilson RS. "Figure 8" ipsilateral autokeratoplasty.Arch Ophthalmol. 1976;94:121-122.

[15] Vasco-Posada J. Ipsilateral autokeratoplasty.AmJ Ophthalmol.1967;64:717-721.

[16] Sah WJ, Myoung YW, Hahn TW, Kim JH. Rota-tional autokeratoplasty in advanced lipidkeratopathy.Ophthalmic Surg Lasers. 1997;28: 1020-1024. ExpOphthalmol.1994;232:538-544.

[17] Gillette TE, Nebres DW. Computer modeling of ro-tational autokeratoplasty. In: Cavanagh HD, ed.TheCornea: Transactions of the World Congress on the Cornea New York, NY: Raven Press; 1988:237-240.

[18] Menezo JL, Taboada JF, Cisneros AL, Ferrer E.Rotational autograft, reconstruction of the ante-rior segment, and intraocular lens implantation. J Cataract Refract Surg. 1986;12:146-149.

[19] Verma N, Melengas S, Garap JA. Ipsilateral rota-tional autokeratoplasty for the management of cor-neal opacities. AustNZJ Ophthalmol. 1999;27:21-25.

[20] Miller D, Wolf E. A model for comparing the optical properties of different-sized corneal grafts.Am J Ophthalmol. 1969;67:724-728.

[21] Gradle HS. The present status of keratoplasty.Am.J Ophthalmol. 1921;4:895-899