



SIMPLE METHOD OF RESTORATION OF VISION WITH AMNIOTIC MEMBRANE TRANSPLANTATION IN SPHEROIDAL DEGENERATION

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Abstract: Spheroidal degeneration is known to cause symptoms of pain, watering and foreign body sensation and visual deterioration. Management includes lubricants, contact lens, lamellar and penetrating keratoplasty and phototherapeutic keratectomy. They have limitations in the form of availability of tissue and equipment, cost and post-op care. Amniotic membrane transplant (AMT) has been proven effective for ocular surface reconstruction. Therefore this study was done to evaluate the efficacy of superficial keratectomy with AMT in spheroidal degeneration in terms of symptomatic relief and visual improvement. Twenty three eyes of 20 patients were included in the study after complete clinical examination. Superficial keratectomy along with amniotic membrane grafting was done in all cases. Patients were evaluated for symptomatic relief and visual improvement. Post operatively symptomatic relief of one or more symptoms was seen in all eyes. Pre-operative watering, foreign body sensation and irritation was relieved in 73.3%, 86.5% and 79.9% cases respectively. Visual improvement by more than two lines occurred in 21 of the 23 eyes. Corneal haze in the form of a nebular macular opacity was noted in five cases. None of our patients required a repeat procedure. Superficial keratectomy with amniotic membrane grafting is a cheaper and easily available treatment option for providing smooth ocular surface with symptomatic and visual improvement in spheroidal degeneration.

Key Words: Amniotic Membrane Grafting, Adults, Corneal Opacity, Occupational Exposure, Ocular Surface Disorder, Spheroidal Degeneration, Visual Deterioration.

INTRODUCTION

Transparent cornea plays a pivotal role in clear vision and is affected by a number of factors. Age and environmental factors are an important part of these. Degenerations of the cornea including spheroidal degeneration affect the elderly and those exposed to vagaries of the environment and thus add to geriatric problems.

Spheroidal degeneration is usually bilateral, interpalpebral and more commonly seen in males. It presents as translucent, golden brown deposits in the superficial corneal stroma or rarely conjunctiva.^[1] The size, shape and distribution of deposits depend on duration of the condition, environmental and nutritional factors.^[1] It is also known as Bietti corneal degeneration, Labrador keratopathy, Eskimo corneal degeneration climatic droplet keratopathy, Fisherman's keratopathy and Elastotic degeneration of the cornea. It is commonly seen in regions of the world with high level of exposure to ultraviolet radiation like Labrador, Saudi Arabia, the Dahlak islands, India, South Africa, and other arctic and tropical^[2].

Spherules are formed by deposition of degraded plasma proteins at limbus by ultraviolet rays of Sun.^[2, 3] These spherules causes irregularity of corneal surface, vascularization and obliteration of visual axis which leads to pain, watering, foreign body sensation and diminished vision.

Treatment of spheroidal degeneration is^[4-11] temporary and permanent. Temporary methods of treatment include lubricants and contact lens. Permanent treatment methods are lamellar and penetrating keratoplasty. These are dependent on tissue availability; with risk of surgical and post -op complication and also require long term follow up. Recently phototherapeutic keratectomy (PTK) with amniotic membrane transplant (AMT) has been advocated as a permanent method of treatment but it is very costly and equipment may not be available at all centers. These patients are usually outdoor workers and may not be that financially able to afford treatment. An alternative, cheaper but effective treatment is required to improve quality of life in these patients.

Amniotic membrane is known to be effective in ocular surface reconstruction.^[12] Its anti-inflammatory and anti-scarring properties and ability to induce rapid epithelialization of the ocular surface are very helpful in rapid healing after keratectomy for ocular surface reconstruction.

Therefore this study was undertaken to evaluate the efficacy of superficial keratectomy with AMT in spheroidal degeneration in terms of symptomatic relief and visual improvement.

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MATERIALS AND METHODS

A prospective non-randomized interventional case study that adhered to the Helsinki declaration was done including 23 eyes of 20 patients. Cases included had primary superficial spheroidal degeneration (Fig.1A) and underwent superficial keratectomy (Fig.1B) with amniotic membrane graft at our center from Jan 2010 to March 2013. Patients were queried about their presenting symptoms, occupation, previous relevant medical and surgical history and presence of chronic ocular disease. Preoperative examination included best-corrected visual acuity, intraocular pressure, slit lamp examination and fundus assessment. Ultrasonography was done for cases where fundus could not be assessed by ophthalmoscope. Spheroidal degeneration was assessed by slit lamp for extent, depth of lesion and level of stromal involvement.



Fig.1 (A): Central Spheroidal degeneration



Fig.1 (B): After keratectomy

After complete examination patients were selected for this study based on the inclusion and exclusion criteria. Patients with spheroidal degeneration in superior third of stroma without co-existing pathology (like lid abnormalities, corneal and conjunctival problems, known case of glaucoma or gross retinal pathology) were included in this study. Patients with these associated pathologies were excluded from the study. Patients were well informed about the disease and nature of treatment and visual prognosis before taking their consent for surgery.

Surgical Technique

Fresh amniotic membrane obtained from elective caesarean section of serologically negative patients was used for the study. The same surgeon operated all the eyes. The procedure was performed under peribulbar /subconjunctival anesthesia. After epithelial debridement (Fig.1B) with a 15 number blade or crescent knife, lamellar dissection was performed in the involved area and 1 mm beyond into the healthy cornea. The level and extent of dissection was based on pre-operative slit lamp findings. Fresh amniotic membrane was used to cover the raw surface. (Fig.1C) Membrane size was according to area of dissection and one millimeter beyond. Amniotic membrane was sutured with 10-0 monofilament nylon and a bandage contact lens was placed over it.



Fig.1 (C): After AMT

Postoperatively, the patients were routinely treated with topical antibiotic steroid combination drops and cycloplegics in a tapering dose. The patients were followed up every week till suture removal and then every 15 days for 2 months and afterwards every month for 6 months. In the follow-up period visual acuity along with complaints regarding relief from the preoperative symptoms like watering, irritation and foreign body sensation were recorded. On follow up slit lamp bio-microscope examination was done to assess corneal epithelialization, surface regularity, residual disease and scarring. The amniotic membrane was inspected for evidence of any retraction, rejection, loose sutures or loss of membrane. Bandage contact lens was changed weekly and kept till suture removal. Any postoperative complications were made note of and treated promptly. Sutures were removed at four to six weeks.

The results were analyzed for symptomatic relief (reduction or complete relief from watering, irritation and foreign body sensation) and visual improvement.

RESULTS

23 eyes of twenty patients with spheroidal degeneration of various grades were included in the study. They were all males with mean age of 65.5 years ranging from 42-84 years. Three out of these patients had bilateral disease. Table-1 shows the demographic and clinical characteristics of the cases included in the study. All the patients were exposed to outdoor working conditions (table 1). All patients were found to have one or more of the following preoperative symptoms like watering, irritation and foreign body sensation interfering with their daily activities. According to corneal involvement patients were divide into three groups, Total (Fig.3A), central (Fig.1A) and peripheral corneal involvement (Fig.2B). Cases with central or total involvement had direct involvement of visual axis and ocular surface distortion (Fig.3C) leading to decrease in acuity. Cases with peripheral involvement had ocular surface distortion (Fig.2A) causing decreased visual acuity. Six eyes (26.08%) had lesions involving the whole of cornea while in 11 eyes (47.8%) the central cornea was involved, rest 26.08% had peripheral involvement. Visual deterioration was seen in all patients. 16 eyes had a preoperative visual acuity 20/200 or less while seven had visual acuity between 20/200 and 20/60. (Table 1).

Table 1: demographic profile of patients with spheroidal degeneration

No.	Age [in years]	Unilateral / bilateral	Symptoms	V/A	Occupation	Grade of degeneration
1	42	Unilateral	FBS,W	20/60	Construction laborer	Central
2	48	Unilateral	FBS	20/200	Field worker	Central
3	56	Unilateral	FBS, I	20/200	Farmer	Midperipheral
4	58	Unilateral	FBS,W	20/80	Farmer	Total
5	60	Bilateral	FBS	CF	Farmer	Midperipheral
6	60	Bilateral	FBS,W,I	20/200	Farmer	Total
7	62	Unilateral	FBS	20/120	Field worker	Peripheral
8	65	Unilateral	FBS	20/80	Farmer	Central
9	65	Unilateral	FBS	20/400	Farmer	Central
10	68	Unilateral	FBS, W, I	CF	Field worker	Midperipheral
11	70	Unilateral	FBS	20/200	Farmer	Total
12	70	Unilateral	FBS	20/400	Farmer	Central
13	74	Bilateral	FBS,W,I	CF	Field worker	Central
14	76	Unilateral	FBS	20/400	Farmer	Total
15	74	Bilateral	FBS,W,I	CF	Field worker	Total
16	63	Unilateral	FBS,W, I	20/100	Farmer	Midperipheral
17	84	Bilateral	FBS W, I	CF	Farmer	Total
18	84	Bilateral	FBS W I	CF	Farmer	Central
19	80	Unilateral	W, I	20/200	Farmer	Central
20	67	Unilateral	FBS, I,W	20/200	Farmer	Central
21	47	Unilateral	FBS	20/80	Construction laborer	Central
22	79	Unilateral	FBS, W, I	CF	Farmer	Midperipheral
23	55	Unilateral	I,W	20/120	Construction laborer	Central

FBS: Foreign Body Sensation, W: Watering, I: Irritation, CF: Counting Fingers, VA: Visual Acuity

Table 2: Preoperative and postoperative visual acuity

No	Preoperative visual acuity	Postoperative visual acuity	Remarks
1	20/60	20/30	Ref error
2	20/200	20/60	Ref error
3	20/200	20/80	Ref error
4	20/80	20/30	Ref error
5	CF	20/80	Cataract
6	20/200	20/80	Cataract
7	20/120	20/40	Ref error
8	20/80	20/30	Ref error
9	20/400	20/80	Ref error
10	CF	20/200	Cataract
11	20/200	20/60	Ref error
12	20/400	20/80	Ref error
13	CF	20/400	Cataract
14	20/400	20/60	Ref error
15	CF	20/400	Ref error
16	20/100	20/30	Ref error
17	CF	20/400	Cataract
18	CF	20/200	Cataract
19	20/200	20/100	Pseudophakia, AMD
20	20/200	20/80	cataract
21	20/80	20/20	Pseudophakia
22	CF	CF	Mature cataract
23	20/120	20/30	Ref error

AMD: age related macular degeneration, CF: counting fingers, Ref error: Refractive error

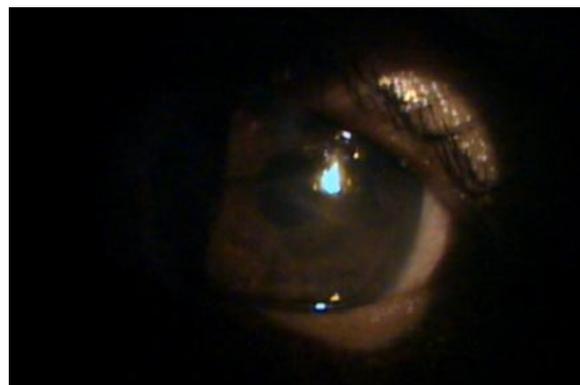


Fig.2 (A): Post-op Mid peripheral spheroidal degeneration

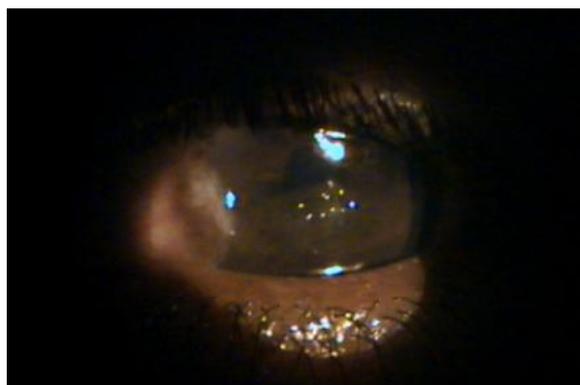


Fig.2 (B): Pre-op Mid peripheral spheroidal degeneration



Fig.3 (A): total spheroidal degeneration Pre-op



Fig.3 (B): Post-op AM in place



Fig.3(C): Post-op corneal haze

Post operatively symptomatic relief of one or more symptoms was seen in all eyes. (Table 3) Relief from pre-operative watering was achieved in 16 patients (73.3%), 19 cases (86.5%) had no foreign body sensation while irritation was relieved in 18 (79.9%) cases. Visual improvement by more than two lines occurred in 21 of the 23 eyes. (Table 2) Of the two patients not showing improvement after surgery, one had mature cataract and one was pseudophakic with age related macular degeneration, which was diagnosed after media clarity, improved.

Seven patients had preexisting lens changes including one patient with mature cataract. Cataract surgery was done in all seven patients after ocular surface stabilization between six to eight weeks of spheroidal degeneration removal. IOL power calculation and cataract surgery was easier to perform, as the corneal surface was smoother and clearer after keratectomy and AMT.

Table 3: Postoperative symptomatology and Complications

No.	Age	Laterality	Symptoms	Postoperative symptoms	Complications
1	42	Unilateral	FBS,W	Symptom free	Residual cornea
2	48	Unilateral	FBS	Symptom free	
3	56	Unilateral	FBS,I	Symptom free	
4	58	Unilateral	FBS,W	Symptom free	Graft lost
5	60	Bilateral	FBS	Symptom free	
6	60	Bilateral	FBS,W,I	Partially symptom free, mild FBS,W,I	Corneal haze
7	62	Unilateral	FBS	Symptom free	
8	65	Unilateral	FBS	Symptom free	Graft retraction
9	65	Unilateral	FBS	Symptom free	
10	68	Unilateral	FBS, W ,I	Partially symptom free, mild FBS,W,I	Corneal haze
11	70	Unilateral	FBS	Symptom free	
12	70	Unilateral	FBS	Symptom free	
13	74	Bilateral	FBS,W,I	Partially symptom free, mild FBS,I,W	
14	76	Unilateral	FBS	Symptom free	
15	74	Bilateral	FBS,W,I	Partially symptom free, mild FBS,W	Corneal haze
16	63	Unilateral	FBS,W ,I	Symptom free	
17	84	Bilateral	FBS W, I	Symptom free	
18	84	Bilateral	FBS W I	Symptom free	
19	80	Unilateral	W ,I	Partially symptom free, occasional W	
20	67	Unilateral	FBS, I,W	Partially symptom free, no FBS, only W,I	Corneal haze
21	47	Unilateral	FBS	Symptom free	
22	79	Unilateral	FBS ,W, I	Partially symptom free, only mild W,I	Corneal haze
23	55	Unilateral	I,W	Symptom free	

FBS: Foreign Body Sensation, W: Watering, I: Irritation

Postoperative complications were few. A total limbus -to- limbus amniotic membrane cover was used in two patients. In one patient, evidence of AM retraction (Fig.4) was observed on the seventh postoperative day which was re-sutured in place and in another case there was loss of membrane after 12 days but by that time complete epithelialization was achieved and thus the patient did not require re-grafting. Corneal haze in the form of a nebular macular opacity was noted in five cases. None of our patients required a repeat procedure.



Fig.4 AM: Retracted post-op

DISCUSSION

Various methods of treatment like sector iridectomy [4], corneal epithelial debridement, lamellar and penetrating keratoplasty, Excimer laser

phototherapeutic keratoplasty have been advocated for treating spheroidal degeneration and have met with varying degrees of success. Cost factor and availability of resources remain a limiting factor in widespread use of these methods of treatment. Thus the need for an effective and affordable mode of treatment is felt which needs to be addressed. Amniotic membrane grafting with superficial keratectomy represents a form of treatment, which meets these criteria.

Spheroidal degeneration is a disease of the outdoors and occupational history of our patients revealed that they were all exposed to sunlight around eight hours a day. In this study, we had 23 male patients with average age of 62.91 years who underwent superficial keratectomy and amniotic membrane grafting. Rao A et al.,^[8] in a similar study of superficial corneal degeneration treated with amniotic membrane grafting with superficial keratectomy had 15 cases of spheroidal degeneration. There were 14 males and one female with an average age of 67.4 years.

Our patients presented with watering, irritation and foreign body sensation. In the study by Rao A et al.,^[8] all patients complained of watering, irritation and visual compromise. They evaluated both subjective and objective improvement after surgery. After surgery two patients had persistent irritation and one patient had watering. One patient had watering and vision compromise persisting after surgery. In our study overall relief of one or more symptoms was seen in all eyes. Watering was relieved in 16 patients, irritation in 18 and foreign body sensation in 19 cases respectively.

We divided the lesion into central, peripheral and total corneal involvement. There were eleven cases with central involvement and peripheral and total involvement had six cases each. A.K. Gupta et al., divided the cases into central and peripheral involvement with almost equal cases in each category.^[8] Badr et al.,^[10] divided the lesions into smooth and rough spherules

Phototherapeutic keratectomy has also been advocated for treatment of superficial corneal lesions with good visual outcome. Sharma et al.,^[6] did a study for 22 cases of spheroidal degeneration using the 193 nm Ar F excimer lasers with a 6mm optic zone. Salah t et al.,^[5] also used PTK for corneal surface ablation prior to cataract surgery. PTK was done for up to seven sittings and intraocular lens power calculation was done after a mean period of 3.3 months.

Hashemi and Dadgostar^[7] advocate the use of automated lamellar keratoplasty for superficial corneal

degeneration. A 130 or 250 micron flap is removed from the diseased cornea using a microkeratome, and replaced with a donor flap of similar thickness. The flap was glued in place and covered with a BCL.

Rao A et al.,^[8] used preserved amniotic membrane along with superficial keratectomy to treat spheroidal degeneration.

We used fresh amniotic membrane after superficial keratectomy and sutured it in place and covered it with a bandage contact lens.

Complications have been described with all the procedures Saleh et al.,^[5] found fine subepithelial reticular haze in two cases after PTK. Badr et al.,^[9] found delayed healing and infectious keratitis occurring after PTK. Hashemi and Dadgostar^[7] did not report any infection or rejection after surgery. They did not report any repeat procedure or interface haze postoperatively. Rao A^[8] found graft retraction in four cases. Residual disease was seen in one case and recurrence occurred in one case. They did not report any infection occurring post-surgery. We found graft retraction and loss of graft in one case each. Corneal haze was seen in four cases after surgery. No recurrence or infection was seen in any case.

Postoperative outcome was measured using visual acuity and symptomatic improvement. PTK has been advocated for treatment of spheroidal degeneration since quite some time and gives good symptomatic relief and visual outcome. Occurrence of post ablation haze is a complication which may be visually debilitating.^[5,6,7]

Saleh et al.,^[5] had a final spherical equivalent of +/- 1 D in 60% of their cases following PTK. Sharma et al.,^[6] found remarkable visual improvement and symptomatic relief in the patients after PTK. Hashemi and Dadgostar^[7] found good best corrected contact lens visual improvement in their cases.

Use of fibrin glue with an automated lamellar graft requires a donor tissue and microkeratome, which may not be easily accessible to all. Thus though it gives good results; use is limited because of the cost factor and long term follow up.^[9]

Use of preserved amniotic membrane also gives similar results.^[8] Availability and cost of preserved amniotic membrane was a main factor to use fresh amniotic membrane in our series with similar comparable results.

Rao A et al.,^[8] found objective visual improvement in 12 of 15 eyes. Relief of all preoperative

symptoms was seen in 11 of 15 cases while four cases reported partial relief of symptoms.

Overall relief from one or more symptoms was seen in all cases and visual improvement was noted in 21/23 cases in our study. Two cases that did not improve had mature cataract and Age Related macular degeneration respectively. This procedure could achieve smooth ocular surface, which enable us to perform proper biometry and cataract surgery successfully.

Thus we find that instead of costlier alternatives, superficial keratectomy with amniotic membrane grafting proves to be a cheaper and easily available treatment option for providing symptomatic relief and improving the ocular surface resulting into improvement in vision.

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