

Anterior Segment Optical Coherence Tomography Study of Pterygium in Conjunctival - Limbal Autograft Transplantation

Shivali Yadav¹, Harsh Bahadur^{2*}, Sukhdeep Bains³, Renu Dhasmana⁴

^{1,2,3,4}Department of Ophthalmology, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Jolly Grant, Dehradun, India.

*Corresponding author's: Harsh Bahadur

Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 03 Nov 2023	Introduction: Progressive, gradual, non-malignant proliferation of fibro-vascular tissue, occurring due to repetitive limbal stem-cell irritation & neovascularization, is referred to as pterygium. It is widespread in equatorial regions of the world, with a prevalence of 22% over a well defined 'pterygium belt'. pterygium excision leaving bare sclera leads to the re occurrence, where as supplementing bare sclera with conjunctival autograft reduces the recurrence up-to 6%. Objective: Assessment of pterygium thickness pre-operative ly & post-surgery keratectomy area along with graft thickness after conjunctival limbal autograft transplantation (CLAT) surgery by anterior segment optical coherence tomography (AS- OCT). Method: 50 patients with primary pterygium were distributed age wise in 4 groups of 20-39, 40-59, 60-79 & 80-99 years. Anterior segment imaging was performed with RT-vue spectral domain AS-OCT. pterygium thickness pre-operatively & keratectomy area along with autograft thickness after CLAT surgery was evaluated for a follow-up period of 3 months. Results: the pre-op pterygium & 3 months post-op keratectomy area thickness at apex for (group 1) were 854um & 573um, (group 2) were 855um & 578um, (group 3) were 859um & 574um and (group 4) were 868um & 575um. Similarly at limbus for (group 1) are 1.13um & 720um, for (group 2) are 1.14um & 725um, for (group 3) are 1.19um & 718um, for (group 4) are 1.24um & 714um. Reduction in graft thickness in 3 months follow period for (group 1) was 311um, (group 2) 304um, (group3) 303um & (group 4) 313um respectively. Conclusions: CLAT ascertains to be the ideal treatment modality for pterygium management in terms of decreasing the complications & recurrence rate. Also, AS-OCT is the optimal investigating modality in assessment of pterygium before & after CLAT surgery.
CC License CC-BY-NC-SA 4.0	Keywords: Pterygium, Anterior Segment, OCT, AS-OCT, CLAT

1. Introduction

Pterygium is a gradual, painless, progressive, nonmalignant proliferation of fibro-vascular tissue (1), due to repetitive limbal stem cell irritation & neovascularization (2), more commonly seen in warm and dry climate. It is wide spread in equatorial region in tropical & subtropical countries, with aprevalence of 22% over a well-defined 'pterygium belt' (3, 4). In India prevalence is 9.5% -13% (5). Ultraviolet radiations (290-400nm) mediated genetic trauma alters the expression of various growth factors, cytokine, matrix~metalloproteinases, which participate in bowman's membrane dissolution, tissue remodelling and neovascularization, therefore, the re is a disrupted balance between population of corneal and conjunctival epithelial cells which eventually results in advancement of conjunctiva over the cornea leading to the pterygium formation (6).

Also, dysregulation in stem cell micro environmental niche due to limbal epithelial stem cells irritation leads to pterygium development (7). VEGF is detected in higher amount in pterygium in comparison to the normal conjunctiva, which plays a major role in pterygium recurrence.

AS-OCT isanoptimalinvestigatingmodalityinreproducingusefulresultsforassessment of pterygium (8), as the higher resolution images at a faster pace that is, 18-25um axial resolutions at 2000A-scans/second are obtained (9). It is the high definition three dimensional quantitative tools, which acts on low coherence interferometry principle. It evaluates anatomy of various ophthalmic structures by measuring

their optical reflection (10, 11). Ideal surgical modality for preventing pterygium recurrence is CLAT, because “limbal stem cells in the conjunctival limbal autograft” acts as a barrier to the conjunctival cells, and prevent the m from migrating onto the corneal surface and hence its recurrence decreases to almost 6% postCLAT surgery (12, 13).

2. Materials And Methods

This study was done in the “Department of Ophthalmology, Himalayan Institute of Medical Sciences, over a time period of 12 months. Patients were taken from the out-patient department. Permission from “ethical committee” was obtained.

Type of Study

Our's is a observational follow-up type study which included 75 patients with complaint of primary pterygium, in which 25 patients were dropouts. Patient who did not followed uptill 3 months were not included in the further study.

Inclusion criteria:

We have taken all cases with primary pterygium, who underwent CLAT surgery and afterwards were followed up till 3 months postoperatively.

Exclusion criteria:

In our study we have excluded all the cases with prior conjunctival and sclera surgery, Recurrent pterygium, Pseudo pterygium, limbal stem cell deficiency, Ocular surface disorders, Severe dry eyes and Lid abnormalities respectively.

Study Protocol:

This study included consecutive patients attending the outpatient department with the diagnosis of primary pterygium for a period of 12 months. Written informed consent was taken before enrolment.

Procedure

Out of 75 patients 50 completed follow-up and were taken for analysis. Clinical assessment of the pterygium and it's grading was done as per T and H. pterygium grading system (14). the n pterygium excision with CLAT surgery was done under local (2% lignocaine with 0.5% bupivacaine and 5IU/ml hyaluronidase) anesthesia.

Head of pterygium was carefully dissected off from cornea with the help of crescent knife. the n pterygium size was marked with callipers and excised from surrounding conjunctiva with the help of Westcott scissors. Sharp dissection of underlying fibrovascular tissue was done up to the insertion of medial rectus muscle. Adequate cautery was done to control the bleeding. then measurement and marking of required (approximately 1 mm larger than the resected pterygium area) graft size in superotemporal region of bulbar conjunctiva was done.

Simultaneously, a circumferential incision was made at the limbus equal in dimension to the resected pterygium, now this free conjunctival limbal autograft, which was obtained after ensuring that no tenon's tissue was included, placed in appropriate orientation at the limbus onto the bare sclera bed. Then 6-8in no.10-Onylon (ethicon) interrupted sutures were applied over the graft area on its conjunctival side & 1sutureonits limbal side securing onto the recipient bed was done, eye patched for 24hrs.

On postop day 1 AS-OCT measurement of keratectomy area at apex, limbus & graft thickness at 1 mm from the sclera spur was done, patient was prescribed topical medication sprednisolone 6 times, moxifloxacin 6 times, carboxymethylcellulose 6 times and was called for follow-up after 1 week. All sutures were removed at week 1, AS-OCT measurements were done & topical treatment was tapered off. the non subsequent visits ASOCT measurements were done on 1**month and 3 months respectively.

Statistical Analysis

The collected data was incorporated in “MS Excel 2010. Different statistical analysis was performed by using SPSS software version 22. the level of significance had the criterion that $p < 0.05$ was regarded as statistically significant. Descriptive statistics were calculated for quantitative variables. Frequency along with percentages was calculated for qualitative and categorical variables. Differences in means of quantitative variables in the groups was tested using, unpaired 't' test & 1-way ANNOVA test.

3. Results and Discussion

Analysis included data from 50 eyes of 50 patients, with primary pterygium, with no other ocular surface disorder. Age of the patients ranged from 22—90 years with a “mean age of 48.04 years”.

Out of 50 patients, 19(38%) were males and 31 (62%) were females with the male/female ratio being 0.61. Therefore, female preponderance was seen. No complications or recurrence was seen during 3 months follow-up period. As per age-wise distribution of patients in 4 groups, maximum number of patients were seen in group II, aging between (40-59) years.

Table 1 shows group wise comparison of pre operative average thickness of pterygium at apex for group I, II, III & IV with average thickness of keratectomy area post operatively on pod1, 1 week, 1 month & 3 months.

Table 1: Group wise comparison of pre operative average thickness of pterygium at apex

Group-wise Distribution	Pre-op (um)	Pod1 (um)	Post-op 1week (um)	Post-op 1month (um)	Post-op 3months (um)	p-value
Group I	854	394	564	569	573	0.001
Group II	855	399	569	574	578	0.001
Group III	859	395	565	570	574	0.001
Group IV	868	396	566	571	575	0.001

Table No. 2 shows group wise comparison of pre operative average thickness of pterygium at limbus for group I, II, III & IV with average thickness of keratectomy area post operatively on pod1, 1week, 1month & 3 months.

Table 2: Group-wise comparison of preoperative average thickness of pterygium at limbus

Group	Pre-op (mm)	Pod1 (um)	Post-op 1week (um)	Post-op 1month (um)	Post-op 3months (um)	p-value
Group I	1.13	491	711	716	720	0.001
Group II	1.14	496	716	721	725	0.001
Group III	1.19	489	709	714	718	0.001
Group IV	1.24	485	705	710	714	0.001

Table 3 shows group wise distribution of post-operative average thickness of conjunctival autograft transplant (um) at 1mm from the sclera spur on pod 1) 1week, 1month & 3 months.

Table 3: Group-wise comparison of preoperative average thickness of conjunctival autograft transplant

Group	Pod1(um)	Post-op 1week(um)	Post-op 1month(um)	Post-op 3months(um)	‘p’value
Group I	416	356	114	105	0.001
Group II	408	350	113	104	0.001
Group III	412	353	119	109	0.001
Group IV	419	359	116	106	0.001

Table no. 4 shows group wise distribution of patients according to pterygium grading where grade II pterygium is more prevalent in group I with n=10 (20%) patients followed by group II with n=8 (16%) patients followed by group III with n=5 (10%) patients. Grade III pterygium is more prevalent in group I with n=13 (26%) patients followed by group I with n=7 (14%) patients followed by group III with n=6 (12%) patients, whereas only 1(2%) male patient was there in group IV.

Table 4: Group wise distribution of patients according to pterygium grading

Group	Grade II			Grade III			‘p’value
	Male	Female	Total	Male	Female	Total	
GroupI	5(26%)	5(16%)	10(20%)	4(21%)	3(10%)	7(14%)	0.474
GroupII	4(21%)	4(13%)	8(16%)	3(16%)	10(32%)	13(26%)	
GroupIII	1(5%)	4(13%)	5(10%)	1(5%)	5(16%)	6(12%)	
GroupIV	0	0	0	1(5%)	0	1(2%)	

Table no.5 shows groupwise pterygium grading according to TAN D H pterygium grading syste

Table 5: Groupwise pterygium grading according to TAN DH pterygium grading system.

Group	Intermediate	Progressive	Average Size(mm)	Stocker's Line	Cap	Episcleral Vessels
Group I	10		3.5	-	-	Visualised
Group I		7	4.6	+	+	Obscured
Group II	12		3.8	-	-	Visualised
Group II		9	4.9	+	+	Obscured
Group III	6		3.9	-	-	Visualised
Group III		5	5.1	+	+	Obscured
Group IV		1	5.3		+	Visualised

Our observational follow-up study included 50 eyes of 50 patients, with primary pterygium, with no other ocular surface disorder. Age of the patients ranged from 22—90 years with a “mean age of 48.04 years”. Out of 50 patients, 19(38%) were males and 31(62%) were females with the male/female ratio being 0.61. Therefore, female preponderance was seen. We have observed complete corneal epithelium recovery along with successive graft thinning over 3 months of our study period.

None of the patient showed recurrence during the study period. In a similar study conducted by Wu et al., in 2014 estimated the “corneal epithelium thickness alterations after pterygium excision with conjunctival autograft transplantation by Fourier Domain AS-OCT” on 152,731d 5th and 7th day post-operatively in 22 patients with 1° pterygium. At the 7th post-operative day, 66.7% patients had a full-fledged recovery of keratectomy area. Also, the y had stated that FD-AS-OCT is an effective tool for demonstrating the healing of keratectomy area (15). whereas in our study we had comparatively a larger sample size. also, we have measured pterygium thickness preoperatively keratectomy area thickness along with conjunctival limbal autograft thickness post CLAT with AS-OCT & followed our patients for a period of 3 months and found complete recovery of the keratectomy area and successive decrease in graft thickness.

In a similar study conducted by Ozgurhan, et al., 20 patients with 1° pterygium and 20 with recurrent pterygium were enrolled, who were examined pre and post—operative lyat 1day, 1stweek, 1stmonth and 3 months post pterygium excision by Visante-AS-OCT which measured central graft area, graft thickness at 1mm, 2mm and 3mm behind the Scleral spur. This study concluded that there is graft thinning and faster healing of conjunctival epithelium post operatively within 3 months period of study in both the groups (16). In our study we excluded the patients with recurrent pterygium and have taken 50 patients with 1° pterygium and followed the m for changes in keratectomy area thickness as well as post-CLAT graft thickness for a period of 3 months and documented complete keratectomy area recovery with successive graft thinning.

In a similar study done by Kheirhah et al. in 2011 evaluated the conjunctival autograft thickness after pterygium excision with use of 0.02% mitomycin-C application, with the aid of AS-OCT in 11 eyes of 11 subjects with 1° pterygium at post-operative 1% week, 1month and 3month and demonstrated conjunctival graft thickness at 1mm, 2mm and 3mm posterior to Scleral spur. their average graft thickness measured by AS-OCT in all regions decreased from 458+/-171um at 1% week, to 291+/-124um at about 3 month postoperatively. Thus, they concluded that AS-OCT, quantitatively aid in the accurate graft thickness measurement, which had decreased successively with in a period of 3 months of their study duration (17).

Where as in our study we had a comparatively larger sample size (n=50) and we did not used mitomycin-C during our surgery, & unlike previous studies where they used free conjunctival autograft, we used conjunctival limbal autograft. Also, we measured pterygium thickness pre-operatively & keratectomy area and graft thickness postoperative ly with the help of AS-OCT and have observed that graft thickness in all the 4 groups decreased successively, & keratectomy area healed completely within our study duration of 3 months.

An observational prospective study was done by Pujol et al., in Spain in 2014 to detect the sequential optical coherence tomography changes in the post pterygium excision with the use of 0.025% mitomycin-C with application of conjunctival limbal autograft. The tissue recovery process & respective healing indicators were analysed. 73 patients with 1° pterygium (33 male, 40 females with mean age 50 years) were included. AS-OCT imaging was done at 1 week, 1, 3, 6 & 12 months after pterygium surgery, “Slitlamp biomicroscopy” was Also done at each visit of each patient, to identify the postoperative healing or recurrence (if present) in the lesion. Parameters analyzed were corneal epithelial, conjunctival epithelial, limbal demarcation area, and postoperative graft thickness.

Consequently, it was seen that 11 eyes presented with recurrence (R-group) where as 62 eyes had no recurrence (NR-group) respectively.

Tissue recovery healing indicators were well established by AS-OCT images of corneal, conjunctival & limbal zone in non-recurrent group (NR) in comparison to the Rgroup where most of the patients did not show any healing indicators of tissue recovery. Also, at 6 months different healing patterns in both the groups were consolidated, where significant higher amount of limbal demarcation areas were observed in the NR group, whereas, healing indicators of normal limbus was never observed in R-group. Sequential tissue restoration as elicited in OCT images, starts from cornea and ends towards the limbal area.

OCT images 6 months postoperatively showed well defined limbal demarcation zone in Rgroup as compared to NRgroup. Therefore, spectral domain OCT well established the 6 sequential changes in % progressive tissue recovery after pterygium excision, not only it identified earliest changes related to complete healing of corneal, conjunctival epithelium & limbal demarcation zone but also earliest changes, which were leading to pterygium recurrence (18). In our study mitomycin-C was not used, operative AS-thickness found recurrence pterygium and ultraviolet radiation: a positive correlation. we took pre-OCT measurements of pterygium thickness and postoperative AS—OCT measurements of keratectomy area and graft and no during 3 months follow-up period.

4. Conclusion

It was observed that the re was complete keratectomy area recovery post-operatively association in with successive graft thinning, when measured with AS-OCT over a period of 3 months. Also, no recurrence was seen within the study duration. the only short coming of our study was a short follow-up period of 3 months & small size of study population. Subsequent, randomized control trials, which have more participants and longer follow-up time are needed to confirm our conclusions in years to come.

Acknowledgments

I would like to express my sincerest gratitude to Almighty, my parents, & my husband for without them, I would not have had the wisdom to come so far and nor the perseverance to continue. My deepest gratitude to my guide, Dr. Prof. Harsh Bahadur & my co-guide Dr. Sukhdeep Bains, because with their timely guidance, sincere advice and kind support I was able to complete my work. I would Also like to express my gratitude towards Dr. Prof. Renu Dhasmana, Professor & Head of Department Ophthalmology, HIMS, for inspite of her overly busy schedule, she always managed to help me, shaped my future & made me the person I am today.

Conflict of interest

The authors declare that they have no conflict of interest.

Informed Consent

Informed consent was taken from the patients participating in this study.

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