Optical Coherence Tomography Analysis Of The Macula After Scleral Buckle Surgery For Retinal Detachment: A Diagnostic And Therapeutic Advantage

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Abstract: Background: To study the different structural alterations in macula after scleral buckling surgery on Optical Coherence Tomography and corelate with postoperative visual acuity. Material And Methods: Total 50 patients with Rhegmatogenous retinal detachment who underwent scleral buckling surgery were included. The study has been approved by ethics committee. Clinical examination and Preoperative oct and postoperative oct on day 7, 1 month 3 month and 6 months were done. Result: After Scleral buckling Surgery post operatively after 1 week(38%),1 month(20%),3 month(8%),6 month(4%) in male and 1 week(20%),1 month(16%),3 month(6%) and 6 month(2%) in female had Persistent Subretinal fluid .Pre operative eyes with subretinal fluid Mean LogMAR VA was 2.21 which was improved to 1.60 on post operative 6 month period. p value 0.033(p value<0.05) was clinically significant suggested that resolution of subretinal fluid during 6 month period significantly improved Visual Acuity. Inner segment/Outer segment (IS/OS) junction of photoreceptor was disrupted in 23(46%) eyes with 21 eyes (54%) in macula off and 2(18%) eyes in macula on. In our study ELM was intact in 23(46%) eyes with 91% in macula on and 13% in macula off eyes. The Mean LogMAR VA in Eyes with Intact ELM was 1.71 and 1.91 in disturbed ELM signified that visual outcome depends on intactness of ELM. Conclusion: IS/OS disruption, Intact ELM and subretinal fluid may be important predictors of visual outcome after anatomically successful RRD surgery.

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Key Words: Optical Coherence Tomography, Scleral Buckling, Retinal Detachment

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Introduction: Rhegmatogenous Retinal detachment is the most common type of retinal detachment which occurs when a tear in retina leads to fluid accumulation with separation of Neurosensory retina from the underlying Retinal pigment epithelium. It is an emergency condition for surgical intervention whether scleral buckling or Pars plana vitrectomy.[1] The anterior-posterior dimensions of retinal break(s) and areas of significant vitreoretinal degeneration and vitreoretinal traction are also important considerations in planning a buckling procedure. Scleral buckles should support all edges of the retinal breaks and associated areas of vitreoretinal degeneration[2] two approaches are established to achieve this objective. One is an external approach using scleral indentation with silicone material called 'scleral buckling'.[3]

Various materials have been used for scleral buckling, including fascia lata, palmaris tendon, Plantaris tendon, knee cartilage, donor sclera, dura mater, polyviol, polyethylene, encircling non absorbable and absorbable sutures, gelatin, hydrogel, and silicone. The latter is far the most popular. Episcleral implants are currently employed in the vast majority of cases. These can be segmental or encircling in configuration.[4,5,6,7] Scleral buckling is surgical procedure in which silicon band or sponge (explant) is used externally for apposition of detached retina to retinal pigment epithelium and prevent further fluid leakage and sealing of all break by cryotherapy.

Optical Coherence Tomography (OCT) is a non-invasive diagnostic technique that renders an in vivo cross sectional view of the retina. OCT utilizes a concept known as inferometry to create a cross-sectional map of the retina that is accurate to within at least 10-15 microns.[8,9]

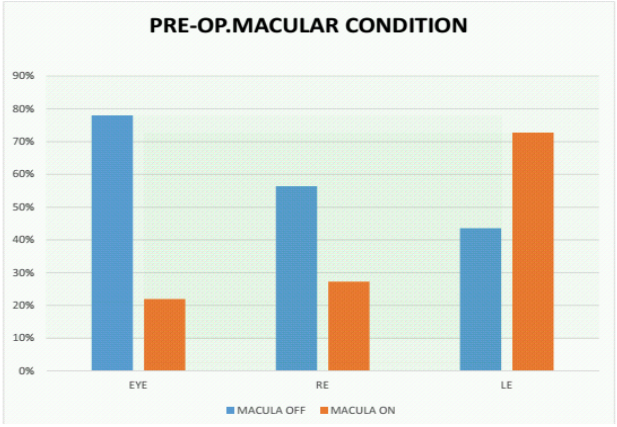
Spectral Domain OCT enables visualization of macular microstructure. Visual outcome after successful retinal detachment surgery is less satisfactory even after anatomical attachment of Retina in Macula off Eyes.[10] The advent of optical coherence tomography (OCT) resulted in a number of reports of persistent SRF after RRD surgery.[11,12,13]

Material & Methods: Total 50 Patients with Rhegmatogenous Retinal detachment who were undergoing Scleral buckling surgery were recruited over a 3-year period.Clinical examination and Preoperative oct and postoperative oct on day 7, 1 month 3 month and 6 months were done.

Before surgery patients underwent best corrected visual acuity (BCVA), routine blood investigation, intraocular pressure, Dilatation of both eye with Tropicamide and Phenylephrine and Fundus examination with indirect ophthalmoscopy and slitlamp biomicroscopy for macular involvement. Pre operative OCT was done. Then patients were operated for retinal detachment surgery by scleral buckling after written informed consent .On postoperative period Antibiotic-steroid drops and cycloplegics and lubrication given.

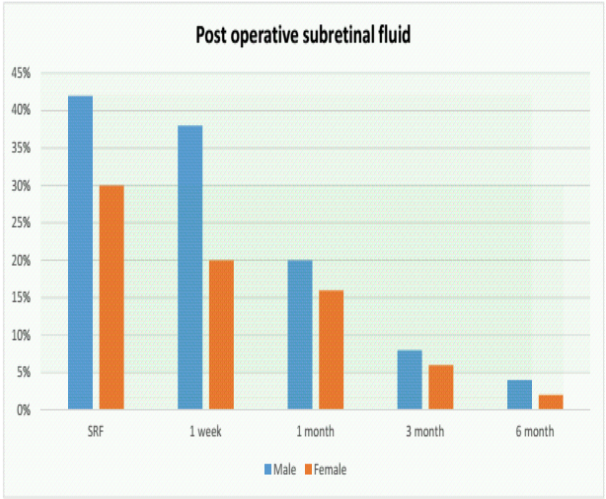
On each post operative visit evaluation of BCVA, Dilatation with tropicamide and phenylephrine and fundus examination was done and Then all patients underwent an OCT examination on 7th day, 1 month, 3 month and 6 month. OCT images were taken with the SD-OCT direct cross-sectional imaging device- Topcon using the macular thickness protocol. Six consecutive scans were performed for each eye. The OCT system then analyzed retinal thickness, creating a topographic map and graphs for quantitatively and qualitatively documenting any changes in retinal thickness and edema. All scan were evaluated for persistent SRF. Scans were obtained with a Horizontal cross sections through the fovea, Scan shows 3 distinct lines indicating reflection from the ELM, Ellipsoid zone, Retinal pigment epithelium/Bruch's membrane, respectively then each OCT image were interpreted.

Graph1: Pre Operative Macular Condition In Oct



Graph 2 shows Post Operative OCT examination performed on post operative follow visit at 1 week,1 Month, 3 Month and 6 Month.

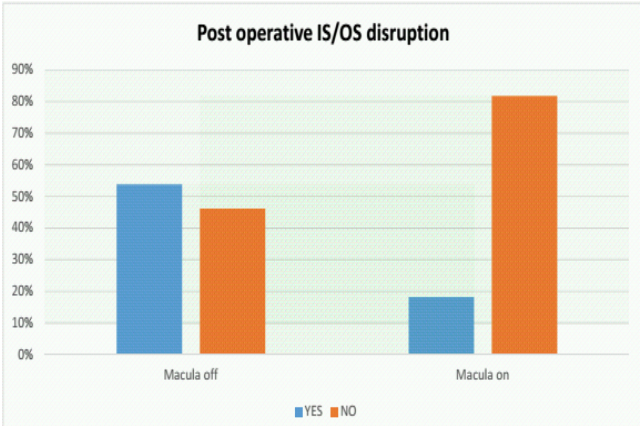
Graph 2: Post Operative Sub Retinal Fluid In Oct



Results: A total of 50 patients who underwent scleral buckling surgery between 2015 to 2017 were studied. There were 30(60%) male and 20(40%) female in our study. The Age of patients in our study varied from 18-80 years with mean age of 62 years. Graph 1 shows Preoperative macular condition in both group macula off and macula on.

Graph 3 Shows Post operative IS/OS Disruption in comparison of Macula off and Macula on both group.

Graph 3: Post Operative IS/OS Disruption



Garph 4 shows post operative Intactness of ELM outcome in both group with comparisons of Macula off and Macula on.

Graph 4: Post Operative Intactness Of Elm

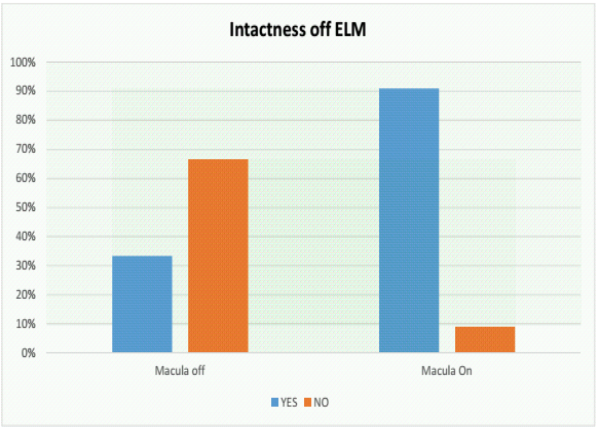
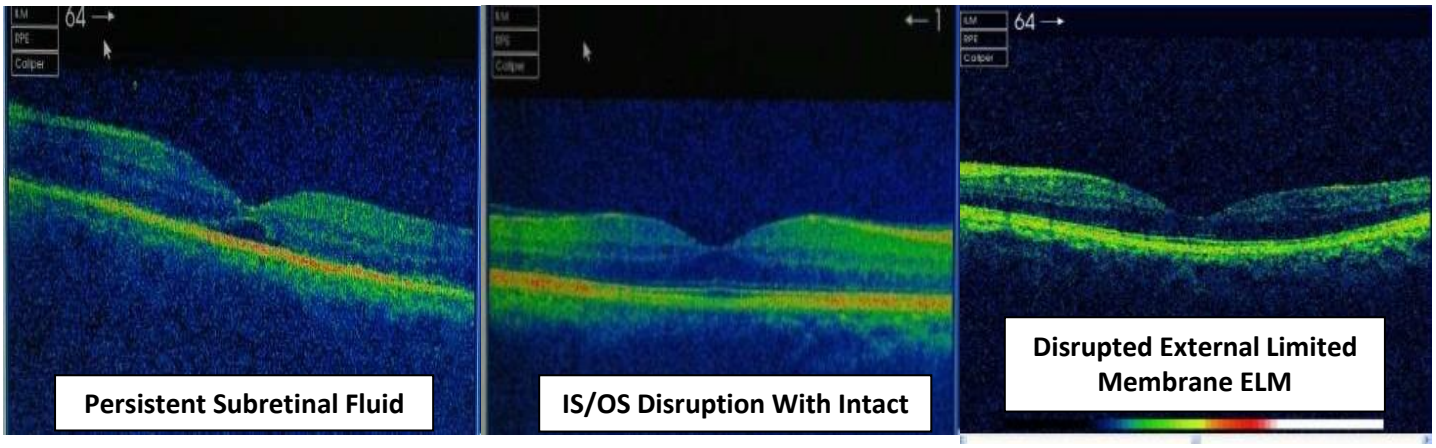


Figure 1 Captured to shows Post operative OCT in focus of Persistent Subretinal Fluid, IS/OS disruption with Intact, Disrupted External limited membrane ELM.

Figure1: Post Operative OCT Image



With the help of STATA software statistical data analysis was performed. Table 1 A shows post operative sub retinal fluid was less (p=0.33).

Table 1 (A): Comparision Of Visual Acuity In Different Changes Of Macula In Oct:

Variable	Pre Operative	Post Operative	P value
Sub Retinal Fluid	2.21	1.60	0.33

Table 1 B shows Mean LogMAR VA is better in patients having INTACT ELMMean LogMAR VA is better in patients of No IS/OS disruption. Mean LogMAR VA is better in patients having INTACT ELM.

Table 1 (B): Comparision Of Visual Acuity In Different Changes Of Macula In OCT:

IS/OS Disruption	Mean LogMAR VA
Yes	1.56
No	1.31
Intact ELM	
Yes	1.17
No	1.91

Discussion: Optical Coherence Tomography analysis of Macula after scleral buckling surgery for Retinal detachment has been investigated in various studies previously. Spectral Domain OCT enables visualization of macular micro structure. Visual outcome after successful retinal detachment surgery is less satisfactory even after anatomical attachment of Retina in Macula off Eyes.[14] In which fovea become detached from underlying Retinal Pigment Epithelium and damage in microstructure which effects the Post operative Visual Acuity.

In our study 50 patients (30 male&20 female) agreed to participate,50 eyes(25 right eyes&25 left eyes) who had undergone an anatomically successful repair of Rhegmatogenous RD were enrolled. Pre operative VA ranged from 6\18 to light projection in all Quadrants. In Post Operative period using Spectral Domain OCT the various Micro structural changes were persistent subretinal fluid, Inner Segment/Outer Segment (IS/OS) junction disruption and Intact External limiting membrane(ELM).Pre operative period 42% Male and 30% female had Subretinal fluid ,After Scleral buckling Surgery post operatively after 1 week(38%),1 month(20%),3 month(8%),6 month(4%) in male and 1 week(20%),1 month(16%),3 month(6%) and 6 month(2%) in female had Persistent Subretinal fluid.

Pre operative eyes with subretinal fluid Mean LogMAR VA was 2.21 which was improved to 1.60 on post operative 6 month period. p value 0.033(p value<0.05) was clinically significant suggested that resolution of subretinal fluid during 6 month period significantly improve Visual Acuity.

In One study Nakanishi et al. showed, using their prototype SD-OCT ,that a preoperative foveal loss of IS/OS at detached macula was significantly correlated with postoperative VA[15]. In Our study Inner segment/Outer segment (IS/OS) junction of photoreceptor was disrupted in 23(46%) eyes with 21 eyes (54%) in macula off and 2(18%)eyes in macula on .The Mean LogMAR VA in eyes with IS/OS disruption was 1.56 and 1.31 in eyes with

preserved IS/OS junction. This study has shown that damage to the IS/OS junction in postoperative SD-OCT image, may explain inadequate postoperative visual recovery. The postoperative integrity of the IS/OS junction as a predictor of VA was also shown in another report.

In Another study, Lin et al revealed that the abnormalities among the External limiting membrane (ELM) or ellipsoid zone were associated with poor visual outcome in eyes after Anatomical successful repair of RRD[16]. In our study ELM was intact in 23(46%)eyes with 91% in macula on and 13% in macula off eyes. The Mean LogMAR VA in Eyes with Intact ELM was 1.71 and 1.91 in disturbed ELM signified that visual outcome depends on intactness of ELM. External limiting membrane disruption was noted in 2 cases in macula on group, this microstructure changes was presented preoperatively and was unrelated to Retinal detachment. In another study results were suggested that no co-relation with VA and intactness of ELM. Our study has some limitations include less sample size, preoperative worst macular condition; chronicity of retinal detachment affect the microstructural damage may require large series of patients.

Conclusion: Optical coherence tomography is a useful noninvasive diagnostic method that can detect SRF not seen on clinical examination. Persistent SRF 1 month after scleral buckling surgery occurs in approximately half of patients, may persist for many months and resolution of SRF over a period of time causes improvement of visual Acuity. Patients with integrity of the ELM(External limiting membrane) are associated with significant visual improvement.IS/OS disruption, Intact ELM and subretinal fluid may be important predictors of visual outcome after anatomical successful RRD surgery.

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