Dissertation on

EFFICACY OF FOCAL LASERS IN CENTRAL SEROUS CHORIORETINOPATHY

Submitted in partial fulfillment of requirements of

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MADRAS MEDICAL COLLEGE

CHENNAI- 600 003

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DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI

APRIL 2017

CERTIFICATE

This is to certify that this dissertation entitled **"EFFICACY OF FOCAL LASERS IN CENTRAL SEROUS CHORIORETINOPATHY"** is a bonafide record of the research work done by **Dr. ARTHI. M,** post graduate in Regional Institute of Ophthalmology and Government Ophthalmic Hospital, Madras Medical College and Government General Hospital, Chennai-03, in partial fulfillment of the regulations laid down by The Tamil Nadu Dr. M.G.R. Medical University for the award of M.S. Ophthalmology Branch III, under my guidance and supervision during the academic years 2014-2017.

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Finally, I am indebted to all the patients for their sincere co-operation for the completion of this study

INSTITUTIONAL ETHICS COMMITTEE
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CERTIFICATE OF APPROVAL

To
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Dear Dr.Arthi.M.,

The Institutional Ethics Committee has considered your request and approved your study titled " **EFFICACY OF FOCAL LASER IN THE TREATMENT OF CENTRAL SEROUS CHORIORETINOPATHY" NO.-15052016.**

The following members of Ethics Committee were present in the meeting held on **03.05.2016** conducted at Madras Medical College, Chennai 3.

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We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

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PART 1

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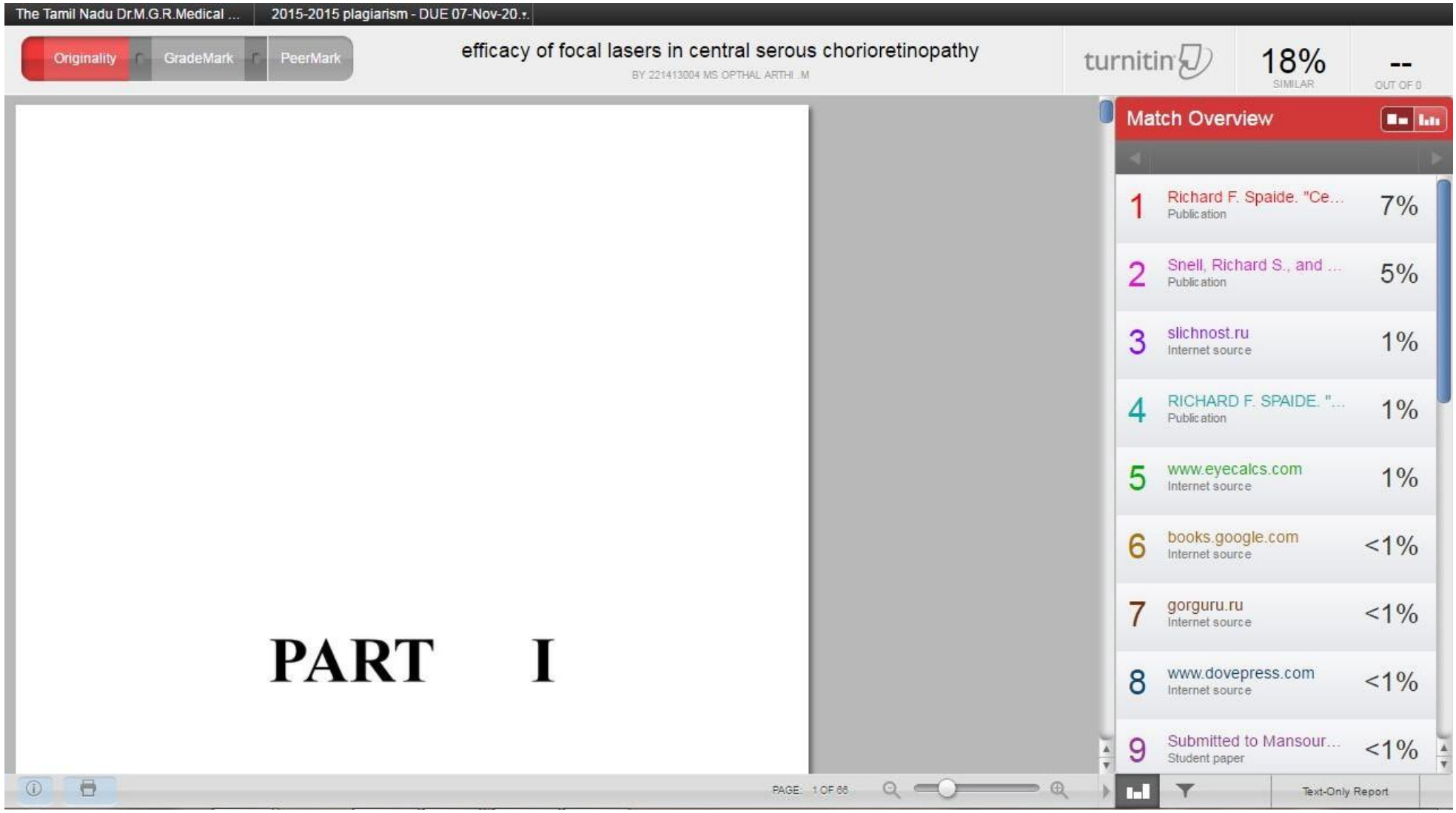
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I hereby declare that this dissertation entitled " **EFFICACY OF FOCAL LASERS IN CENTRAL SEROUS CHORIORETINOPATHY"** is a bonafide and genuine research work carried out by me under the guidance of Prof. Dr. M. Rajakumari M.S., D.O.,

DATE:

PLACE: DR. ARTHI.M

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PART – III

BIBLIOGRAPHY

PROFORMA

KEY TO MASTERCHART

MASTERCHART

PART I

ABBREVIATIONS

CSR - Central Serous Chorioretinopathy

PED - Pigment Epithelial Detachment

FFA - Fundus Fluorescein Angiography

OCT - Optical Coherence tomography

ICG - Indocyanine Green Angiography

BCVA - Best Corrected Visual Acuity

CNVM - Choroidal neovascular membrane

RPE - Retinal Pigment Epithelium

FAZ - Foveal Avascular Zone

INTRODUCTION

Central Serous chorioretinopathy (CSR) is an idiopathic disorder characterized by a localized and circumscribed serous detachment of the sensory retina at the macula secondary to leakage from the choriocapillaris through single or multiple hyperpermeable Retinal Pigment Epithelium (RPE) sites. It is usually confined to the central macula.

CSR has a long history of changing names reflective of the previous uncertainty about the etiology of the pathological process.

Albrecht von Graefe[1] 1866 first described it as a recurrent central retinitis.

Horniker[2] 1922 agreed that the pathology was localized to the retina but thought these patients had an underlying angioneurosis causing angiospasm and exudation. He used the name capillarospastic central retinitis.

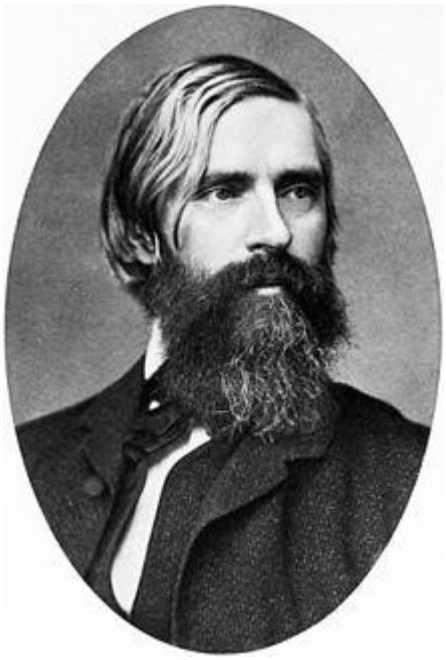
Gifford and Marquardt[3] shared Horniker's view and coined the term central angiospastic retinopathy.

Bennet[4] also localized the disease to the retina and applied the name central serous retinopathy.

Through fluorescein angiography, Maumenee[5] changed the concept of the primary tissue affected by describing the leak occurring at the level of the RPE.

Based on fundus flourescein angiographic findings, Gass[6] added on to this view and termed the condition idiopathic central serous choroidopathy.

Today CSR is the preferred term, since we understand that the neurosensory detachment occurs due to a leak in RPE resulting from the hyperpermeability at the choroid.



ALBRECHT VON GRAEFE

ANATOMY OF THE RETINA AND MACULA

The retina, which is the inner nervous layer of the eyeball, is a thin, delicate and transparent membrane. The surface area of the retina is 266mm $^{2.}$Its thickness in the posterior pole in the peripapillary region is 0.56 mm as compared to its thickness in the ora serrata where it is 0.1 mm. It has a purplish red hue in living subjects which becomes opaque after death.

The retina is has strong attachments to the margins of the optic disc and at the ora serrata.

EMBRYOLOGY

The retina is derived from neuroectoderm, where the Retinal Pigment Epithelium and neurosensory retina are derived from the outer and inner layers of the optic cup, respectively.

THE MACULA

The *macula lutea,* is the area for the most distinct vision is at the centre of the posterior part of the retina. It is a yellowish oval area which measures about 5 mm in diameter and lies about 3 mm to the lateral side of the optic disc. The yellow carotenoid pigment, xanthophylls cause the macula to appear yellow in colour. The fovea centralis is the central depressed area in the canter of the macula lutea .It measures about 1.85 mm in diameter. It corresponds to central 5 ^{o} of the visual field and is the most sensitive part of the retina. The foveola, which is 0.35 mm in diameter, forms the central floor of the fovea. A tiny depression in the

centre of the foveola is the umbo which corresponds to the foveal light reflex. There are no blood vessels in the fovea which comprises the foveal avascular zone which is normally around 500 micrometer in diameter.

THE OPTIC DISC

The optic disc lies about 3 mm medially to the macula lutea. It is pale pink and measures about 1.5 mm in diameter. The edge of the disc is slightly raised, while the central part has a slight depression, through which the central retinal vessels enter and leave the eye. It is at the optic disc that the optic nerve fibers exit the eye by piercing the sclera at the *lamina cribrosa*. Posterior to the optic disc, the nerve fibers are myelinated, whereas anterior to the disc they are nonmyelinated. At the optic disc, there is a complete absence of *rods* and *cones;* thus, it is insensitive to light and is referred to as the *blind spot.*

ORA SERRATA

The ora serrata is the scalloped anterior margin of the retina where the nervous tissues of the retina ends. The anterior part of the retina is nonreceptive and extends forward from the ora serrata over the ciliary body to the posterior surface of the iris.

RETINAL PIGMENT EPITHELIUM

This layer consists of a single layer of cells that extends forward from the margin of the optic nerve to the ora serrata anteriorly. The cells are narrow and tall in the posterior polar region and become flattened near the ora serrata. The cells are hexagonal in a tangential section. The basal end of each cell is much infolded and rests on a basement membrane, forming a part of Bruch's membrane of the choroid. The apical ends of the cell show multiple microvilli which are embedded in glycosaminoglycans and act as an adhesive binding the pigment layer to the neural layer. The adjacent cell membranes are bound together in the basal region by the zonula adherens, which encircles the cell, and in the apical region by the zonula occludens, which also surrounds the cell and practically obliterates the intercellular space. These tight junctions form the outer blood retinal barrier. The Inner blood retinal barrier is formed by the zonaoccludens of the endothelial cells of the retinal capillaries bound together.

The RPE plays a pivotal role in photoreceptor renewal, maintaining the blood retinal barrier and transport of nutrients through the blood retinal barrier.

BLOOD SUPPLY

The blood supply of the retina is from two sources.

1) The outer laminae, including the rods and cones and outer nuclear layer, are supplied by the choroidal capillaries.

2) The inner laminae are supplied by the central artery and vein.

The retinal arteries are anatomic end arteries, and there are no arteriovenous anastomoses. Small twigs from the superior and inferior divisions of the central retinal artery supply the macula. Cilioretinal artery is present in 20% of the individuals, which is a branch from the ciliary circulation .

MICROSCOPIC ANATOMY

Based on light microscopic findings, the whole retina was said to be composed of 10 layers. These are, from outside inward, as follows:

1. The pigment epithelium

2. The rods and cones

3. The external limiting membrane

4. The outer nuclear layer

5. The outer plexiform layer

6. The inner nuclear layer

7. The inner plexiform layer

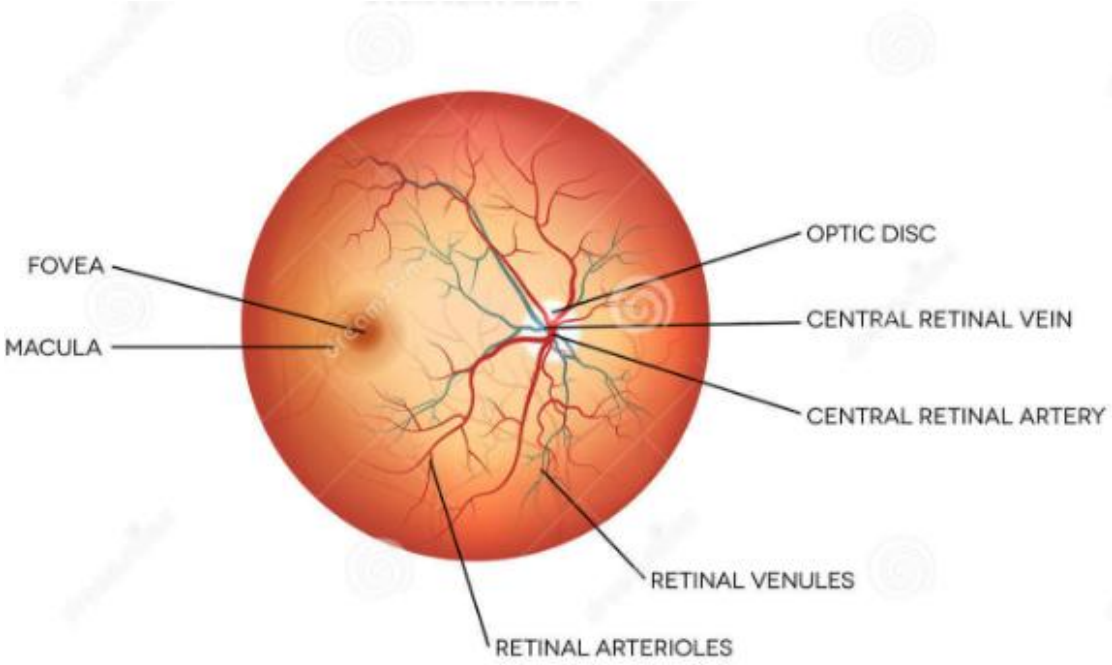
8. The ganglion cells

9. The nerve fiber layer

10. The internal limiting membrane

At the fovea, the fibres of the outer plexiform layer run obliquely forming the Henle's layer. The fovea contains 10% of the cone population of the retina. The foveola contains only the cones and their nuclei and remaining layer of the retina are absent[7].

FIGURE 1 – ANATOMY OF THE RETINA AND MACULA



EPIDEMIOLOGY

The age- and sex-adjusted incidence of CSR in a recent population-based study was found to be 5–6 per 100 000 people[8].

CSR has a tendency to occur in middle aged individuals between the age group of 20 – 50 years. The mean age by two large retrospective case control studies was reported to be 51[9, 10] though older studies reported a mean age considerably lesser than this. CSR is not known to occur in children and prepubertal individuals with only two case report of CSR in children till date[11, 12].

In terms of gender, there is a male predilection with the reported male: female ratio 3:1[9,10].

Race also plays a role in CSR, with more caucasians, Hispanics, and Asians affected and relatively uncommon in African Americans[13].

CSR has been found to be associated with hypermetropic or emmetropic patients in western countries but such an association has not been found in asian countries which has a high prevalence of myopes.

RISK FACTORS FOR CENTRAL SEROUS CHORIORETINOPATHY

Many risk factors have been identified by various investigators for CSR.

- Individuals with **type A personality and mental stress** are implicated as strong risk factors in CSR. Patients with CSR commonly give history of multiple stressful events in their life. This was first emphasized by Yannuzzi[14] in his study based on the the Jenkins Activity Survey, which showed that CSR was more common in individuals with type A personality as compared to controls. Werry and Arends[15] using the Minnesota Multiphasic Personality Inventory Test, showed that CSR patients are more likely to show hypochondria or hysteria and have a conversional neurosis.
- **Endogenous and exogenous hypercortisolism** have been implicated in CSR by multiple researchers. Tittl et al[10], found that corticosteroids are risk factors in addition to psychotropic medications and hypertension. Inhaled, intranasal, intramuscular, and topical dermatological corticosteroids have also been implicated in CSR pathogenesis. Endogenous corticosteroids are also thought to contribute to the pathogenesis of disease.
- Other risk factors, implicated by a study by Haimovici[16] et al, included
    - antibiotics,
    - pregnancy,
    - untreated hypertension,
    - allergic respiratory disease and

- alcohol.

- The association of CSR with **pregnancy** was also reported by Gass[17]. Recent studies by Liu and collegues also implicated Helicobacter pylori infection and sleep disturbances and in individuals with sleep disturbances.[18] The study also confirmed the association of other risk factors listed above.

PATHOGENESIS OF CENTRAL SEROUS CHORIORETINOPATHY

The pathology in CSR consists of separation of the neurosensory retina from the RPE at the macula due to the accumulation of subretinal fluid between these layers.

Patients with CSR may have subretinal deposits of four forms fibrin, lipid, macrophages, and outer photoreceptor segments. Subretinal lipid is usually found in chronic CSC in older patients and appears as discrete, hardedged, subretinal accumulations typically at the borders of a neurosensory detachment. CNVM is a more common disorder causing accumulation of lipid in the subretinal space.

Multiple theories for CSR were put forward and refuted with emerging clinical evidence in the past. The current theory for pathophysiology is based on the demonstration of multiple leaks in case of active CSR and the resolution of the subretinal fluid once the leaks subsided. Normally there is a balance between the tissue oncotic pressure and hydrostatic pressure causes the normal flow of the fluid from the retina to the choroid [19]. The various risk factors listed above lead to the rise in the levels of circulating epinephrine and norepinephrine which increases the hydrostatic pressure. This causes a hyperpermeability in the choroidal vasculature which further leads to pigment epithelial detachment and disruption of the RPE which cause the accumulation of the fluid between the neurosensory retina and the pigmented layer. This is supported by evidence from indocyanine green angiography which shows that the RPE defects overly the areas of choroidal vascular hyperpermeability [20].

HISTOPATHOLOGY

There exists only limited histopathologic information on CSC. Neurosensory detachment with subretinal fibrin deposition has been reported. Yoshioka and Katsume31 described a focal area of degenerated RPE with adjacent damaged choriocapillaris endothelial cells in animal models. These endothelial abnormalities were sealed by platelet-fibrin clots. OCT provides optical biopsies in which retinal atrophy has been visualised. Patients with a history of long standing CSR may develop cystic spaces within the retina which gives rise to cystoid macular degeneration.

CLINICAL FEATURES

SYMPTOMS

Common symptoms of CSR are diminution of vision associated with various distortions including micropsia, metamorphopsia, scotomas, and chromatopsia. The visual acuity is usually mildly reduced to around 6/9 to 6/12 but can be worse than 6/60 in severe or recurrent disease. The visual acuity may be improvable with hyperopic correction. CSR usually tends to be unilateral in younger and bilateral in older patients.

SIGNS

CSR can present in three different ways:

- classic acute chorioretinopathy,
- chronic diffuse retinal pigment epitheliopathy (DRPE), and
- bullous retinal detachment.

Classic or acute CSR, the most common form, consists of a well circumscribed neurosensory detachment at the macula, which may vary in shape from round to oval, elevates the macula and resulting in the neutralisation of the normal foveal reflex. This collection of clear fluid has a characteristic halo formed by light reflexes which leads to the formation of a ring reflex. The detachment may be of variable size.

Retinal Pigment Epithelial Detachments (PEDs) of the serous type are also commonly seen in association with CSR. On biomicroscopy, a PED appears as a wellcircumscribed, orange-colored elevation with a slightly darker rim that can illuminate with a slit beam aimed from the side. When the RPE separates from the underlying Bruch’s membrane it leads to a pigment Epithelial Detachment. These detachments are often less

than 0.25 disk diameter, but can be larger. Some patients may have the deposition of subretinal fibrin.

Chronic Diffuse Retinal Pigment Epitheliopathy the subretinal fluid which is longstanding causes decompensation of the RPE which leads to an altered pigmentation. Patients with Diffuse Retinal Pigment Epitheliopathy generally have a more pronounced and irreversible loss of vision. Examination of the retina with a +90D lens may show thinning and cystoids changes. The associated RPE changes can be any one of the following.

- The RPE atrophy characterised by hypopigmentation and increased visibility of the underlying larger choroidal vessels.
- Focal hyperpigmentation of the RPE.
- RPE hyperplasia which manifests as bone spicules.

Within the detachment, the subretinal fluid may be clear, or with subretinal deposits. This may be suggestive of CNVM.

The rare, form of CSR that causes bullous retinal detachments has numerous exuberant leaks, multiple PEDs, and bullous retinal detachments. This condition is frequently bilateral. These detachments are associated with shifting subretinal fluid and subretinal fibrinous exudates. This has been reported in great number in Japan and among organ transplant patients. Patients with bullous detachment have a large number and increased size of choroidal hyperpermeability areas in ICG angiography. Bilaterality is the norm (84%). While some of the patients initially presented with bullous changes, others converted from classic CSC (36%). Those patients who experienced visual loss greater than 20/40 had macular damage.

FIGURE 2 – ACUTE CSR IN A 29 YEAR OLD PATIENT

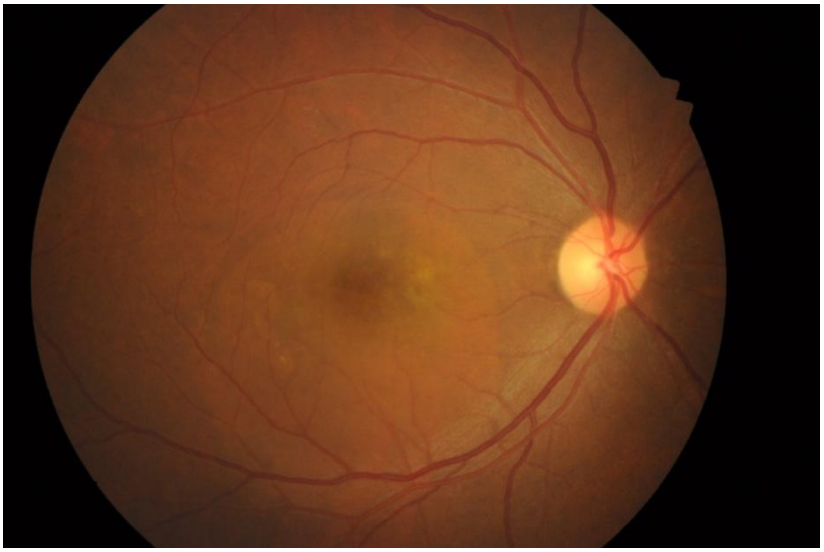


FIGURE 3 – CHRONIC CSR WITH SUBRETINAL PRECIPITATES IN A 38 YEAR OLD PATIENT

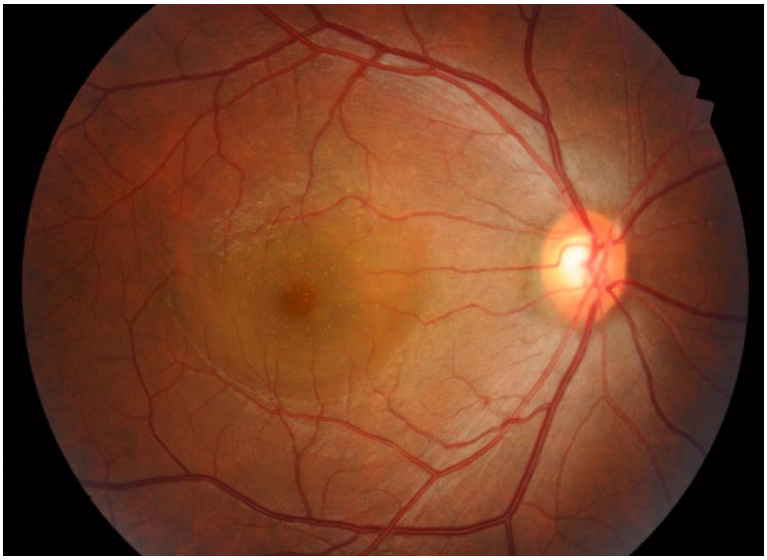
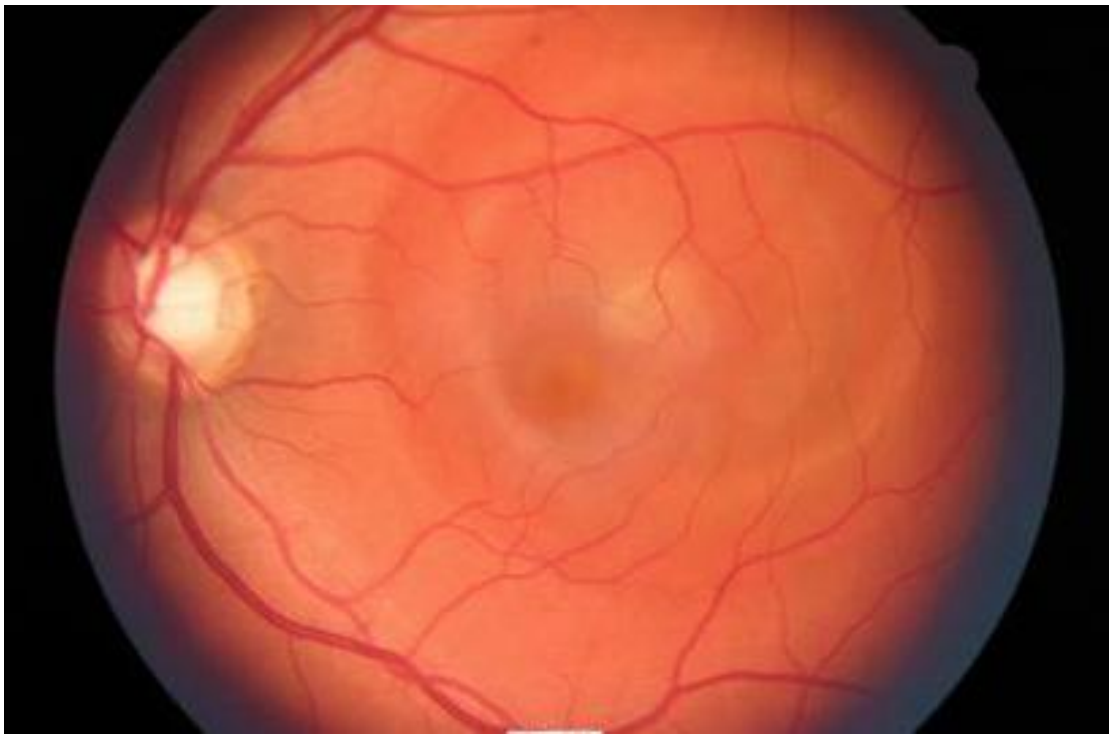


FIGURE 4 – BULLOUS VARIANT OF CSR



INVESTIGATIONS

FUNDUS FLUORESCEIN ANGIOGRAPHY

ACUTE CSR

Fluorescein angiography in acute cases of classic CSC demonstrates a single or multifocal hyperfluorescent spots suggestive of leaks at the level of the RPE. Early in the angiogram, there is a focal dot-like hyperfluorescence representing the leakage of dye from the choroid through the RPE. Later, pooling of the dye occurs through the phases of the angiogram which respects the boundaries of the serous detachment . Two patterns of leakage occur.

- The more common pattern of dye leakage, is the ink blot pattern which is a small dot leak increasing in size throughout the phases of the angiogram.
- The classic smokestack leak described by Shimizu and Tobari in occurs in the minority of cases (10%), but has a dramatic appearance. The leakage first arises superiorly, resembling a smokestack, and then plumes out laterally. This pattern is thought to be caused by the convection currents and a protein gradient, as the subretinal fluid underlying the detachment has a high concentration of protein. Smokestack leaks causes a larger detachment compared to the inkblot pattern.

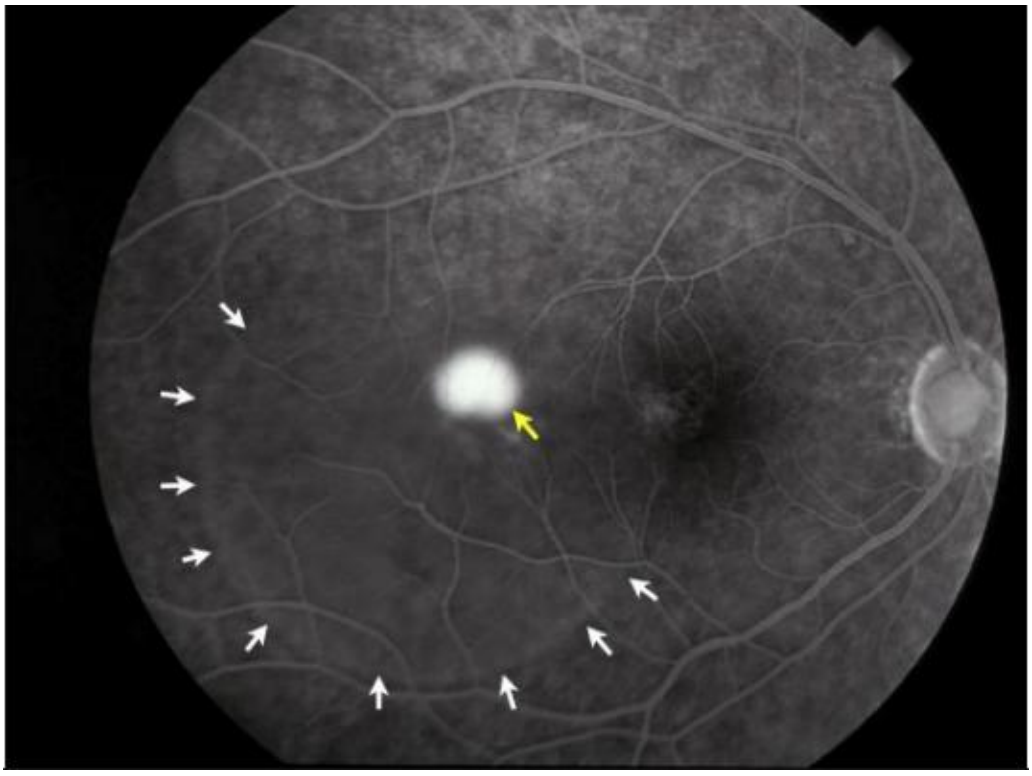
In both types of leakage patterns, focal leaks are found to be more common nasally and in the superior half of the retina. The leakage point occurs in the fovea in less than 10% of cases and within the papillomacular bundle in 20–25% of cases. If a leakage point is not

readily apparent on flourescein angiography, the superior extramacular area should be inspected carefully as gravity might cause a detachment below the leak.

DIFFUSE RETINAL PIGMENT EPITHELIOPATHY

The diffuse areas of altered RPE are readily apparent as areas of hyperfluorescence due to atrophy of the RPE and associated insignificant leaks. Capillary telangiectasis, capillary nonperfusion, and CNVM secondary to chronic detachments may be detected.

FIGURE 5 – INKBLOT PATTERN OF LEAKAGE IN FFA



FUNDUS AUTOFLOURESCENCE

Autofluorescence photography is an investigation which is noninvasive and provides functional images of the fundus based on stimulated emission of light from lipofuscin and related molecules. Lipofuscin, found within the RPE, is a cellular waste product containing lipid, protein, and fluorophores such as A2E. The A2E precursors increase in number if the outer segments are not being phagocytised and they add to the Autofluorescence.

Autofluorescence images can be generated by excitation of the fluorophores with light centered at 580 nm, detection above 695 nm with a barrier filter and recording by a Topcon 50μ fundus camera. Alternatively a Heidelberg retina angiograph (HRA) can be used which is based on confocal imaging. While a healthy macula has a relatively uniform distribution of autofluorescence, an unhealthy macula has more variance related to cell injury and accumulation of abnormal amount of fluorophores. Autofluorescence photography is important in CSR because it provides a noninvasive technique to study the status of both the RPE and outer retina and to assess atrophic changes.

In the acute CSR eyes, the increased metabolic activity of the RPE cause increase in autofluorescence at the site of detachment. [21] In longstanding lesions of acute or classic CSC patients, photoreceptor cell loss leads to decreased or absent autofluorescence. This method therefore, provides a noninvasive assessment of the status of the RPE and outer retina in CSR. This imaging technique helps us understand the pathogenesis of CSR and guide us in management of individual patients.

Autofluorescence imaging of DRPE patients varies according to the degree of cellular injury. There is decreased or absent autofluorescence within longstanding lesions due to photoreceptor cell loss. The increase in autofluorescence in chronic patients may be due to RPE reactive changes. The descending atrophic tracts often seen in DRPE have characteristic patterns. Tracts of more recent origin and the outer edge of more chronic descending tracts exhibit hyperautofluorescence, reflecting the increased lipofuscin within the RPE and A2E products within the outer retina. Patients with a history of CSC

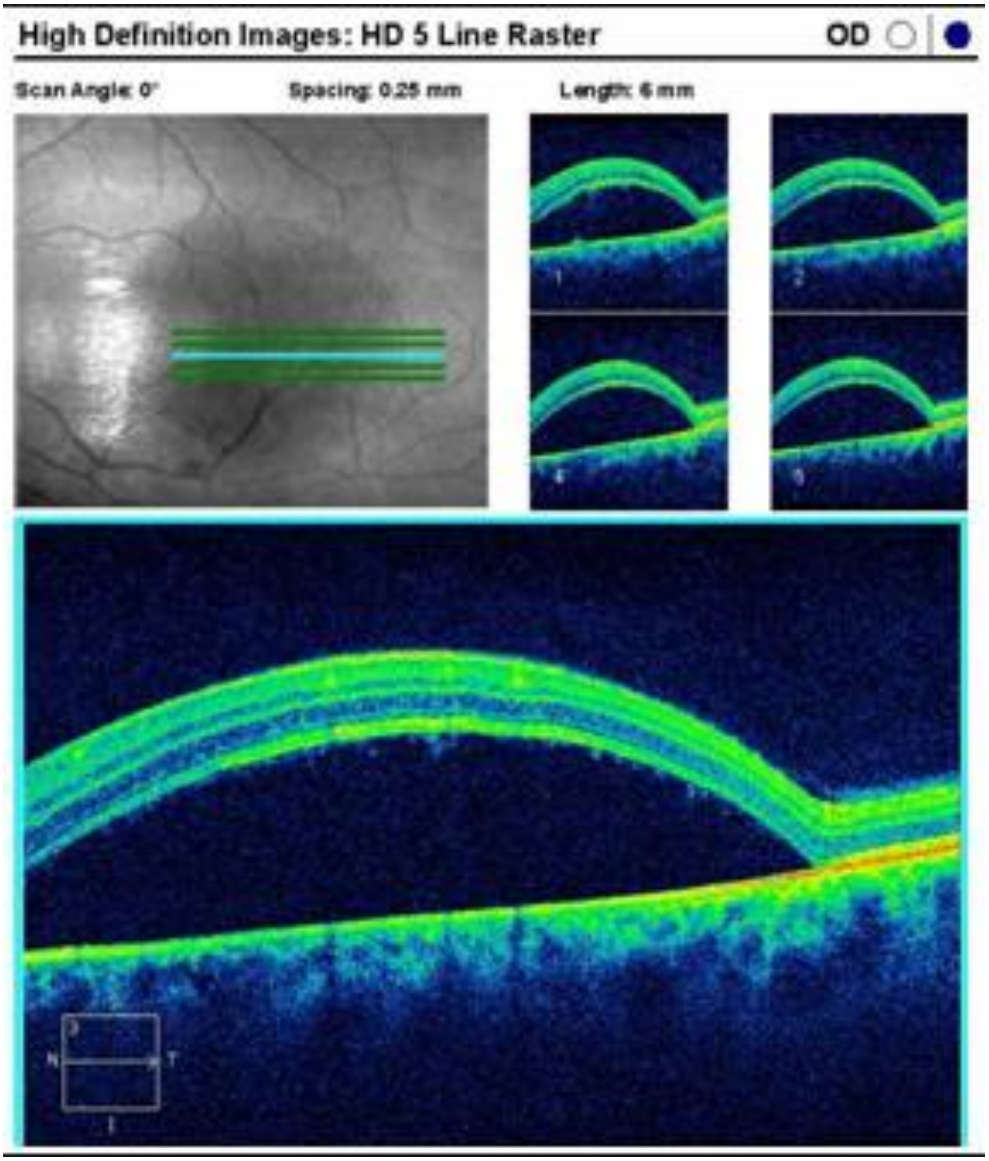
that has been quiescent for many years have only hypoautofluorescent areas, indicative of the RPE atrophy. Autofluorescence photography, therefore, provides a noninvasive tool to monitor cellular function in CSC patients and indirectly determine visual prognosis.

OPTICAL COHERENCE TOMOGRAPHY

OCT provides anatomical information in all types of CSR. A Spanish study which was aimed at comparing OCT findings with fluorescein angiographic patterns documented that eyes with CSR had an optically empty vaulted area under the neurosensory retina consistent with detachment that related to fluorescein-filled areas. The patients also had highly small bulges protruding from the RPE which correlated to the leaking spots in angiography. OCT also demonstrated the presence of as associated PED.

The conventional OCT is useful for detecting subclinical cystoid macular degeneration or foveal atrophy.54 OCT, therefore, provides a noninvasive imaging test complementary to fluorescein angiography. OCT ophthalmoscope is found to be more efficacious compared to conventional OCT. In a retrospective study of unilateral resolved CSR the involved eyes had a decrease in central foveal thickness which had a statistically significant correlation with visual acuity. Additional factors on OCT associated with poorer visual acuity were the inability to visualize the external limiting membrane or the boundary between photoreceptor bodies and outer segments.

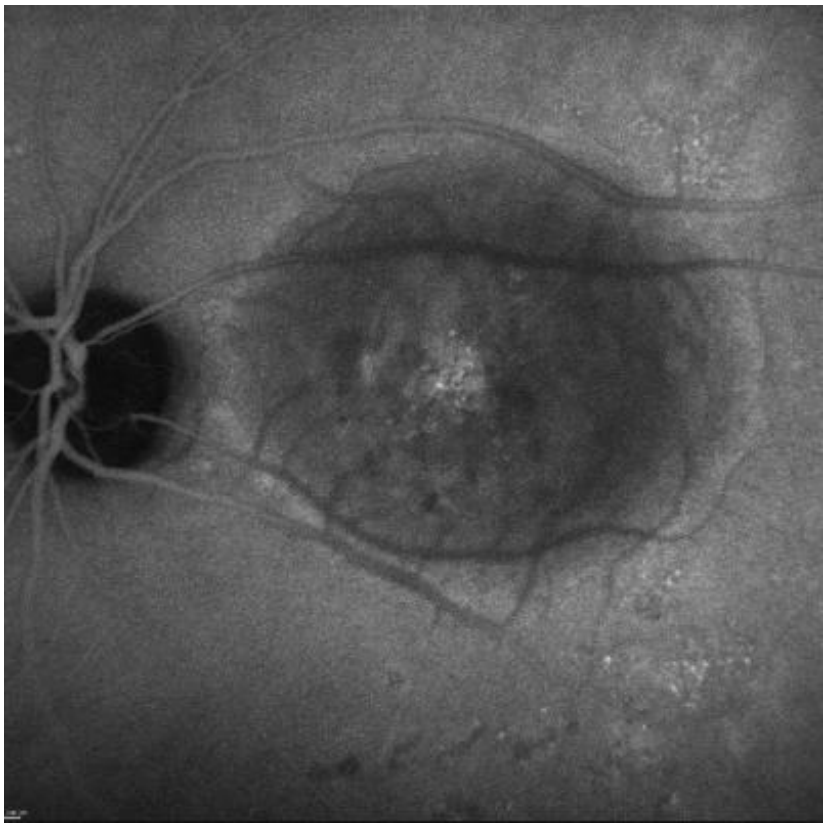
FIGURE 6 – OPTICAL COHERENCE TOMOGRAPHY IMAGE OF CSR

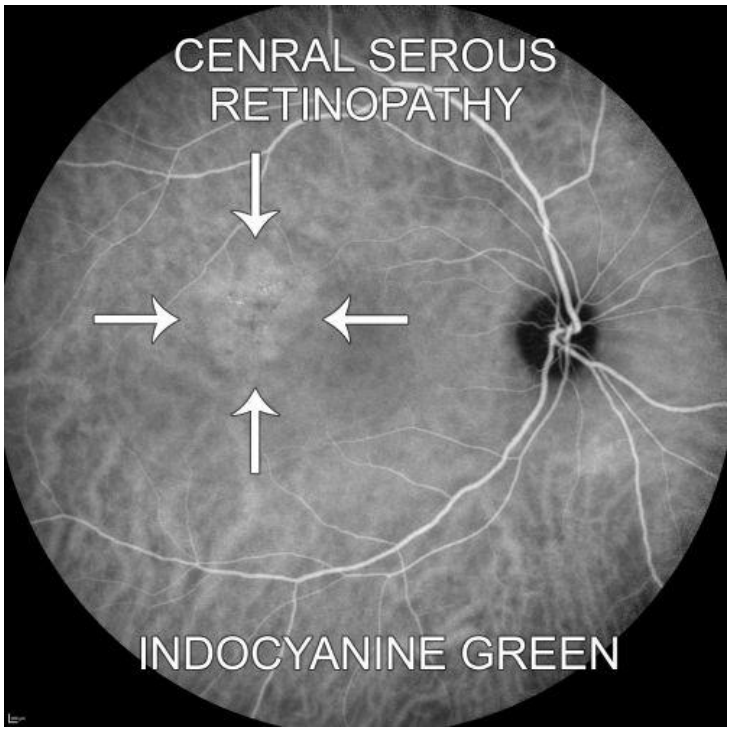


INDOCYANIN GREEN ANGIOGRAPHY

Indocyanine green (ICG) angiography is used to demonstrate areas of choroidal vascular hyperpermeability in cases of CSR. these abnormal areas are localised to the inner choroid and characteristically seen in the mid-phases of the angiogram. Dispersion of the dye into the deeper layers of the choroid is late which produces a characteristic appearance of larger but less prominent hyperfluorescent patches in the choroid. This also produces a silhouetting of the choroidal vessels. Patients with CSC can actually present with no fluorescein leakage during a quiescent phase, may have detectable areas of choroidal hyperpermeability in ICG. Pigment epithelial detachments can also be seen in ICG which are thought to be produced by choroidal hyperpermeability in areas lacking RPE defects which causes the leak to lift up the RPE and cause a pigment epithelial detachment. ICG angiography of DRPE shows widespread choroidal vascular hyperpermeability which is greater number when compared to classic CSR with larger areas of hyperpermeability.

FIGURE 7 – INDOCYANIN GREEN ANGIOGRAPHY IMAGE OF CSR SHOWING HYPERFLUORESCENCE





DIFFERENTIAL DIAGNOSIS

Although the clinical and fluorescein angiographic features of CSC are often classic, several entities should be considered in the differential diagnosis:

- CHOROIDAL NEOVASCULARISATION (CNV): This is the most important differential diagnosis of central serous chorioretinopathy. Both groups of patients are similar in that they may have neurosensory detachments associated with PEDs and areas of mottled depigmentation and/or hyperpigmentation, areas of RPE atrophy, and subretinal deposits of fibrin and lipid. But RPE thickening, notched PEDs and subretinal or subpigment epithelial blood are seen only in CNVM along with findings consistent with new vessel growth. CNVM may occur secondary to many different conditions and they may be differentiated by the other associated findings. The CNVM secondary to other ocular causes such as Age related macular degeneration has ‘classic’ findings on fluorescein angiography - lacy vascular pattern of hyperfluorescence with increasing leakage and staining throughout a fluorescein angiographic evaluation. CSR reveals multifocal areas of choroidal vascular hyperpermeability that is most obvious in the mid-phases of ICG. CNVM shows a unilateral, unifocal area of hyperfluorescence that progressively increases in contrast with the surrounding choroid in the later phases of ICG. ICG may also aid to rule out occult CNVM.
- TUMORS AND INFILTERATIVE CONDITIONS: leukemia, amelanotic melanoma, or metastatic disease, can also appear

similar to CSR. These infiltrative lesions generally have a distinct appearance on comparing with the surrounding normal choroid associated with choroidal thickening on B scan.

- HARADA'S DISEASE OR POSTERIOR SCLERITIS: these conditions may mimic CSR but have cells in the anterior chamber or in the vitreous with yellowish patches in the posterior pole. B scan shows thickening of the choroid.
- KRONENBERGS SYNDROME: these patients have optic nerve pits along with a serous elevation at the macula that may be similar to CSR. The macular elevation due to optic nerve pits differs from CSR because it is generally a bilayer detachment caused by retinoschisis in the macula. There are no leaks in these patients in flourescein angiography.
- RHEGMATOGENOUS RETINAL DETACHMENT: They may mimic the macular elevation in CSR, but they have a horse shoe tear or breaks in the periphery or in the posterior pole.
- VASCULAR DISORDERS
- MALIGNANT HYPERTENSION can produce a serous retinal detachment. The presence of systemic hypertension, Elschnig's spots, shifting fluid, and choroidal or retinal vasculature changes, or both, can distinguish it from CSR.
- TOXEMIA OF PREGNANCY: may present with serous retinal detachment. The systemic findings of hypertension, proteinuria, and edema will separate this condition from CSC seen in pregnant women.

- DISSEMINATED INTRAVACULAR COAGULATON should also be considered in the differential diagnosis of serous retinal detachment in the appropriate clinical setting.

NATURAL COURSE OF THE DISEASE AND OUTCOME

Most patients with CSR resolve spontaneously with recovery of snellen visual acuity [23]. The average time for the resolution of the subretinal fluid is three months. Most patients have a complete visual recovery with a best corrected visual acuity of 6/12 or better[23]. However, inspite of recovery of Snellen visual acuity, complaints of reduced colour vision, relative scotomas, micropsia, metamorphopsia, decreased contrast sensitivity, and nyctalopia may persist in the affected eye. Some patients may complain of distortion in the central field of vision inspite of good visual acuity. This is due to the photoreceptor damage, atrophy, irregular RPE pigmentation, or subretinal fibrosis. Recurrences of subretinal fluid and exudative detachment at the macula are common due to the persistent leaks or recurrents leaks and few patients may progress to DRPE. Recurrences can occur may occur within a few months or many years later. The recurrent leakage point is usually within 1 mm of the initial leakage point in most of the patients of patients. Secondary CNVM is a complication which may occur in patients with long standing CSR.

TREATMENT

The management for acute CSR followed till date by majority of clinicians is masterly inactivity as it has the inherent property to resolve spontaneously without any complications. But when there is persistence of the subretinal fluid for an extended period or when observation is not preferred due to occupational reasons or other reasons in patients various modalities are undertaken to hasten the resolution of the subretinal fluid thus reducing the central macular thickness.

Patients may be asked to stop steroids if any history of usage is present and lifestyle modification may be advocated to alleviate the mental stress.

The various treatment methods which are adopted are aimed at sealing the leak visible in fundus flourescein angiography, or to reduce the choroidal hyperpermeability.

MEDICAL THERAPY

Many drugs have been tried in the treatment of central serous chorioretinopathy. Because of the implication of a psychological component sedative and CNS suppressants were tried in the past but their efficacy has not been proved by randomised control trials. [19] β blockers have also been suggested by certain researchers due to the elevated level of adrenaline in these patients. But this group of drugs come with its own side effects. Ketoconazole, because of its adrenocorticoid antagonistic property has also been studied for use in CSR. Though it lowered the endogenous corticosteroid levels the central

macular thickness and visual acuity remained unchanged at 4 weeks and its long termed effect on these variables is not established[23] .

Oral Rifampicin was also used by some researchers in the treatment of longstanding central serous chorioretinopathy but the side effects of the drug may preclude its usage routinely.[24]

Mineralocorticoid antagonists like spironolactone and eplerenone have been studied in long standing cases, these drugs though they cause resolution of the subretinal fluid donot affect the central macular thickness or the best corrected visual acuity and require randomised control trials to establish the efficacy of these drugs.[24] Epleronone has been shown to reduce the choroidal vasodilatation and hyperpermeabilty and thereby reduction in the subretinal fluid.[25]

Finasteride , 5α reductase inhibitor has also been recommended for use in central serous retinopathy[26] but the side effects have to be kept in mind before prescribing it for male patients and the risk benefit ratio has to be established by randomised control trials.

PHOTOCOAGULATION THERAPY

Laser photocoagulation is the most commonly studied modality in the treatment of CSR. The principal goal of this treatment is to reduce the leakage through the RPE and cause resolution of the subretinal fluid with improvement in visual acuity. Laser photocoagulation to the site of leakage seen during flourescein angiography shortens the duration of macular detachment in patients with typical CSR, but does not appear to affect the final visual acuity. Similarly for DRPE, thermal grid laser to an area with small leaks appeared to cause a decrease in the amount of

subretinal fluid present, but did not cause a long term change in the visual acuity. The effect of laser treatment on the rate of recurrence is inconclusive as it reduced the rate of recurrence in some studies, but not in others.[30,31] For the severe bullous variant, laser photocoagulation did not confer any significant advantage in terms of temporal resolution of serous retinal detachment or final visual acuity outcome. Potential dire side effects of photocoagulation include CNV, scotoma, and RPE scar expansion.

Laser photocoagulation is indicated for the following patients:

- Symptoms greater than 4 months,
- Leakage sites located greater than 375 mm from fixation,
- a history of CSC in the fellow eye with an unfavorable outcome,
- the need or desire for treatment.

A detailed biomicroscopic examination and flourescein angiogram is essential to look for the development of CNVM.

Laser photocoagulation should be performed to the leakage site with low-intensity energy. The laser is set for a spot size of 100–200 mm, power of 100–150mW, with application time of 0.1–0.2 s. With a recent angiogram as guidance, the more peripheral leaks are treated first.

The amount of laser uptake is affected by several variables. These include

the amount of subretinal fluid present, the degree of pigmentation of the RPE, which is variably pigmented in areas of chronic subretinal fluid, the degree of RPE detachment, and the wavelength of laser used.

The leakage point is treated as well as a small surrounding region of normal RPE. Great care should be taken to obtain only a dull gray coagulation to avoid the possibility of secondary CNV. The patient should be monitored carefully to assess for recurrence or laser-induced complications. The subretinal fluid generally takes a few weeks to resorb. The visual symptoms start to improve with the reduction of the subretinal fluid. If hemorrhage, increased turbidity of the subretinal fluid, or thickening at the level of the RPE in or adjacent to the area of laser treatment is noted, secondary CNV should be suspected. The patient should have a repeat fluorescein angiogram at that point to help in establishing the diagnosis. Secondary CNV generally causes a nodular or crescent-shaped area of hyperfluorescence under or adjacent to the area of previous laser photocoagulation. If the original site of treatment was sufficiently extrafoveal, it is possible to discover and treat secondary CNV, in many cases, before the neovascularization extends under the fovea. The CNV may be treated with either thermal laser, if sufficient room exists, or with photodynamic therapy (PDT). Subthreshold micropulse diode laser has been used to treat CSR nowadays. These lasers can be used safely for sub foveal leaks without any adverse effects.

PHOTODYNAMIC THERAPY

This is a new treatment modality for CSR. Studies have shown that PDT causes ischemia of the choriocapillaries which leads to reduced fluid leak and accumulation and resolution of the serous detachment. It may be useful for treatment of DRPE and chronic CSR where laser has not been effective. DRPE is a challenge to treat because of the wide distribution of multiple indistinct leaks. Recurrences of subretinal fluid

do occur, but they are amenable to retreatment with PDT but pigmentary changes may persist. ICG angiography-guided PDT of eyes with chronic CSR eyes has been studied in which the location of laser light application, in our study, was based on regions of choroidal vascular hyperpermeability seen during ICG angiography that were responsible for the fluid leakage into the macula. Safety precautions include avoidance of directly treating the central fovea to help reduce the possibility of inducing foveal atrophy with the PDT. Full fluence and half fluence PDT have been found to be effective in CSR. Because of the high cost of PDT, its use has typically been limited in classic CSR to those patients with focal leaks near the centre of the fovea where laser photocoagulation may induce excessive harm.

PART – II

AIMS AND OBJECTIVES

PRIMARY OBJECTIVES:

To evaluate the efficacy of focal laser in patients diagnosed as CSR with extrafoveal leakage, in terms of visual acuity and central macular thickness and comparing it with the control group.

SECONDARY OBJECTIVES:

1. To study the risk factors implicated in Central serous Chorioretinopathy.

2. To study the association and pattern of CSR with the use of steroids (Systemic, Inhalers, Ointment etc.)

3. To study the FFA patterns and site of extrafoveal leakage in Central Serous chorioretinopathy.

4. To study the use of OCT in Central Serous Chorioretinopathy

MATERIALS AND METHODS

SUBJECT SELECTION

60 patients with Central Serous Chorioretinopathy attending Uvea and Retina services of Regional Institute of Ophthalmology and Government Ophthalmic Hospital were included in the study.

INCLUSION CRITERIA

Patients with CSR in whom

1. Presence of Sub Retinal Fluid involving the fovea for a period of 3 months or longer in optical coherence tomography (OCT) images
2. Patients with CSR induced leakage 500μm away from fovea as demonstrated in FFA.
3. Patients with a history of CSR in the other eye with an unfavourable outcome.
4. Patients with CSR with visual acuity 6/12 (logMAR 0.3) or worse

EXCLUSION CRITERIA

1. Patients with serous retinal detachment unrelated to CSR.
2. Eyes with history of previous Photodynamic therapy or laser photocoagulation.
3. Patients with ocular infective and inflammatory diseases.

METHODS:

All patients diagnosed who were diagnosed as CSR underwent thorough history taking to assess the presence of risk factors causing CSR.

Then patients underwent the following investigations

Visual acuity

Automated refractometry reading and Subjective best corrected visual acuity

Amslers Grid

Slit lamp examination

Slit lamp biomicroscopy with 90D

Indirect ophthalmoscopy

Fundus fluorescein angiography

Optical coherence tomography

60 patients who satisfied the inclusion criteria were selected and randomly assigned to laser group and study group. The patients in the laser group underwent focal laser wherein pinpoint leaks were treated with burns of spot size 100 µm, power of 100 mW of 100 ms duration. The leaks were treated with 3 confluent burns.

FOLLOW UP

Patients were reviewed at 4 weeks and 12 weeks post laser. Visual acuity was reassessed. Slit lamp examination and dilated fundus examination with 90D and Indirect ophthalmoscopy was done. Optical coherence tomography was again repeated during the two visits to reassess the central macular thickness.

DATA ANALYSIS AND RESULTS

Following analysis was done

- The visual outcome by measuring best corrected visual acuity.
- Assessment of Central Macular thickness and resolution of Subretinal fluid by Optical coherence tomography.

RESULTS

1. AGE DISTRIBUTION:

TABLE-1

AGE(in years)	NO OF PATIENTS	PERCENTAGE
21-30	7	11.6
31-40	33	55
41-50	15	25
>50	5	8.3
TOTAL	**60**	100

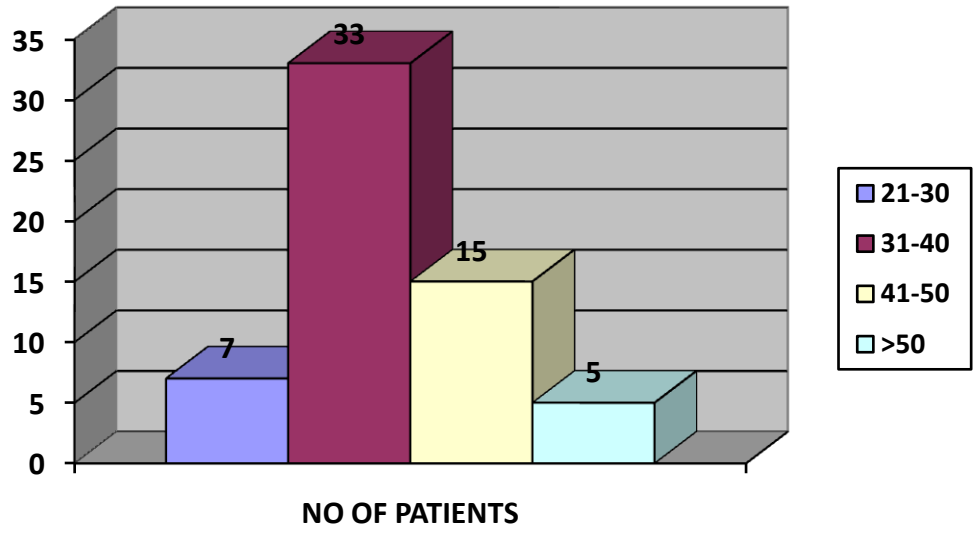


FIGURE - 1

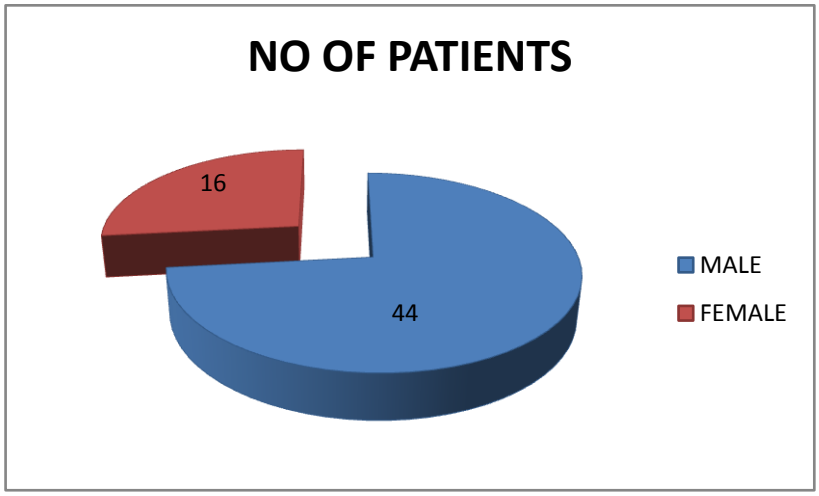
Our study population included patients from 24 – 59 years with a mean age of 38.7. Majority of the patients (55%) belonged to the age group of 31 – 40 years and 25% of patients belonged to the 41 – 50 years group. Only 11.6% belonged to 21 – 30 years age group and 8.3% were above the age group of 50 years.

2. GENDER DISTRIBUTION:

TABLE2:

SEX	NO OF PATIENTS	PERCENTAGE
MALE	44	73.3
FEMALE	16	26.6
TOTAL	60	100

FIGURE -2



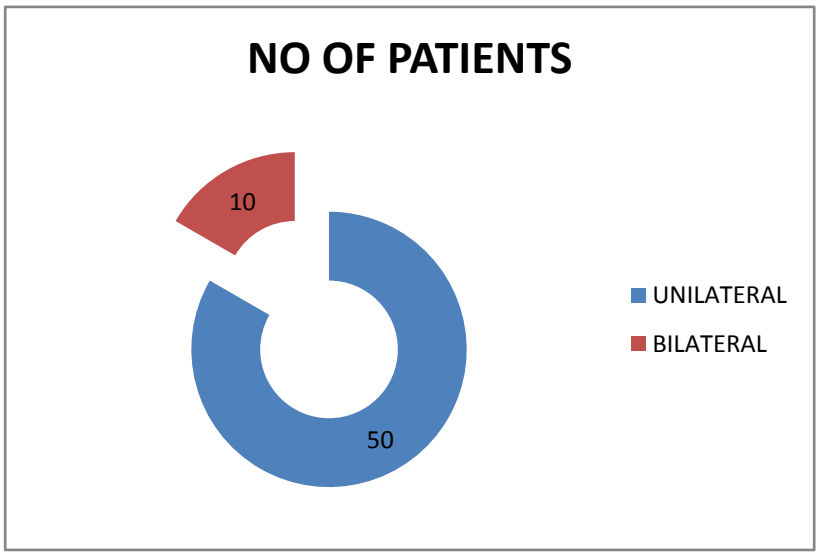
In our study,male subjects outnumbered females subjects. 73.3% of the study population were males and 26.6% were females.

3.LATERALITY

TABLE 3:

LATERALITY	NO OF PATIENTS	PERCENTAGE
UNILATERAL	50	83.3
BILATERAL	10	16.6
TOTAL	60	100

FIGURE – 3



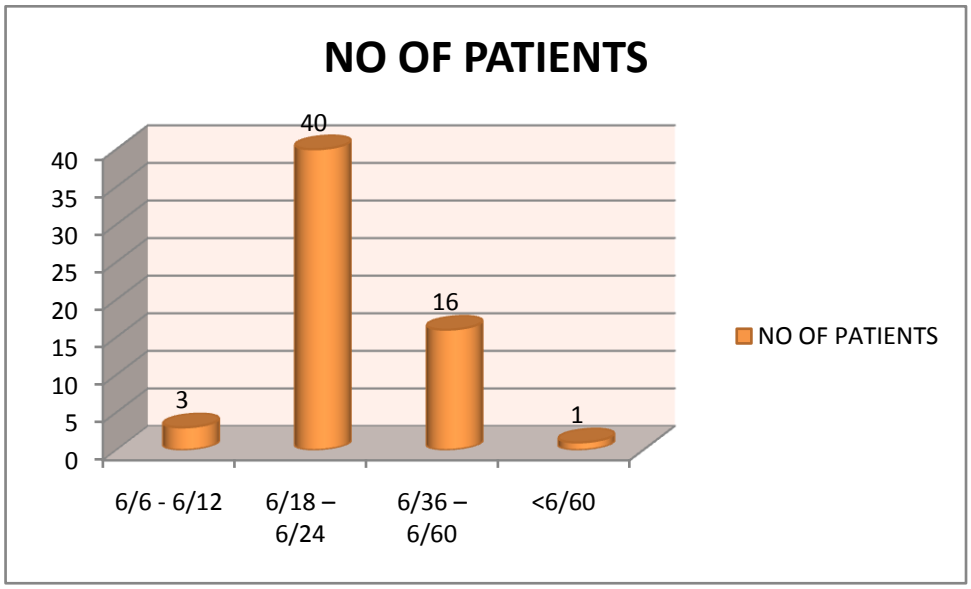
In our study 83.3.% of the patients had unilateral disease and bilateral CSR was present in 16.6% of the patients. In patients with unilateral disease 27 patients had involvement of the right eye and in 23 patients left eye was involved.

4. BEST CORRECTED VISUAL ACUITY

TABLE 4:

BCVA (logMAR)	NO OF PATIENTS	PERCENTAGE
6/6 - 6/12 (0 – 0.3)	3	5
6/18 – 6/24 (0.5 – 0.6)	40	66.7
6/36 – 6/60 (0.8 – 1)	17	26.7
TOTAL	60	100

FIGURE – 4



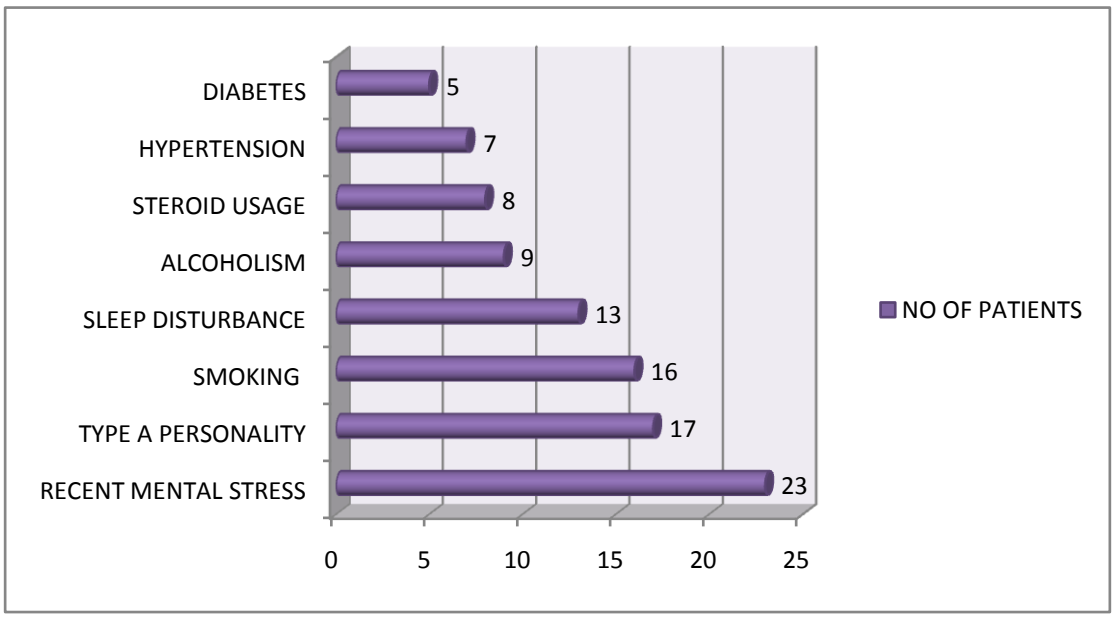
At presentation, 66.7% of patients had a BCVA of 6/18 -6/24, and 26.7% of patients had a BCVA between 6/36 and 6/60. 5% of the patients presented with a BCVA of 6/6 – 6/9.

5. RISK FACTORS

TABLE 5

RISK FACTOR	NO OF PATIENTS	PERCENTAGE
RECENT MENTAL STRESS	23	38.3
TYPE A PERSONALITY	17	28.3
SMOKING	16	26.7
SLEEP DISTURBANCE	13	21.7
ALCOHOLISM	9	15
STEROID USAGE	8	13.3
HYPERTENSION	7	11.7
DIABETES	5	8.3

FIGURE – 5



Presence of mental stress in the recent past due to personal issues was found to be the most significant risk factor with 38.3% of patients

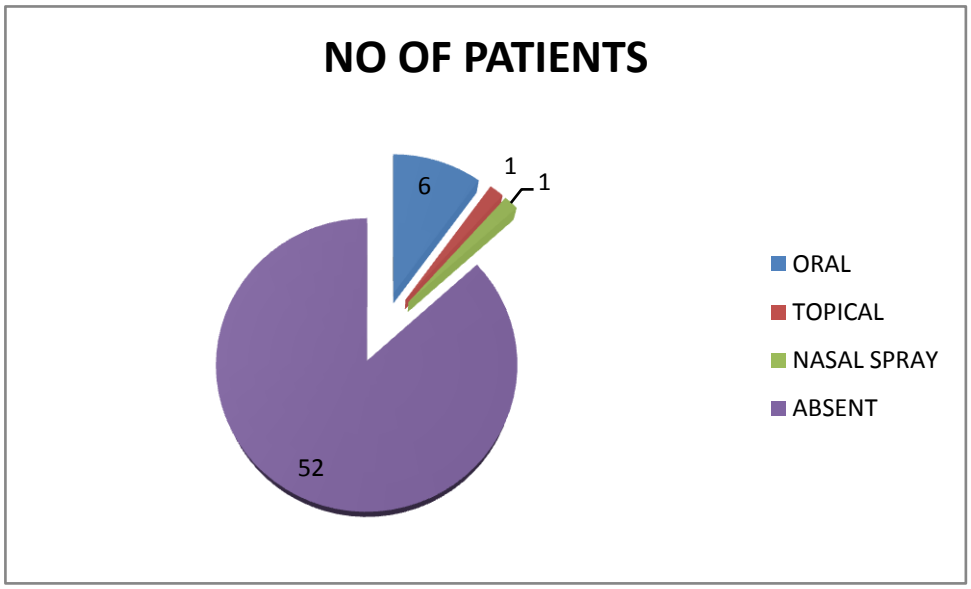
confiding to have the history. The next significant risk factor type A personality with 28.3% of patients belonging to this category. Smoking was present in 26.7% of the patients and sleep disturbances in 21.7% of the patients. 13.3% of patients included in our study gave history of steroid usage. Alcoholism, diabetes and hypertension were present in 15%, 8.3% and 11.7% of the patients respectively. Many patients had a combination of one or more risk factors.

6. ASSOCIATION WITH STEROID USAGE

TABLE - 6

HISTORY OF STEROID USE	ROUTE	NO OF PATIENTS	PERCENTAGE
PRESENT	ORAL	6	13.3%
	TOPICAL	1	
	NASAL SPRAY	1	
ABSENT		52	86.7%
TOTAL		60	100

FIGURE – 6



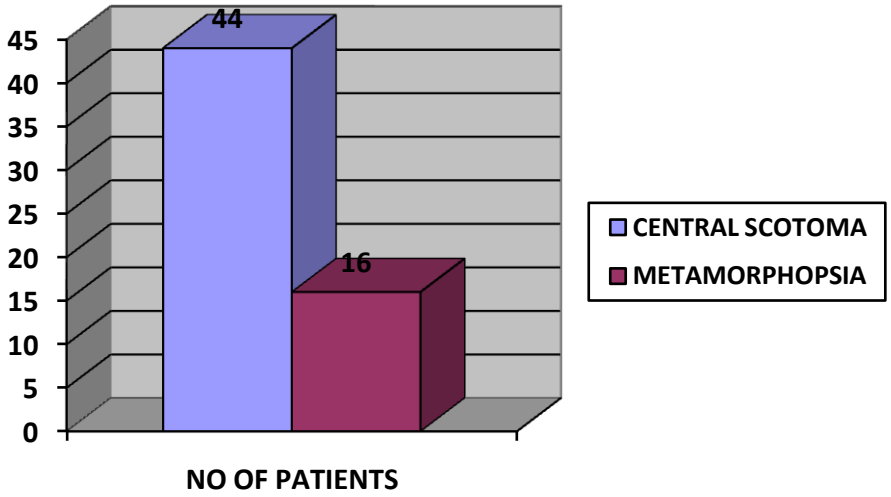
Among patients with a history of steroid usage, 6 patients gave history of using oral steroids for systemic illness. One patient had a history of using steroid nasal spray for allergic rhinitis and one patient gave history of prolonged use of topical steroid following cataract surgery.

7. PRESENTING COMPLAINTS

TABLE- 7

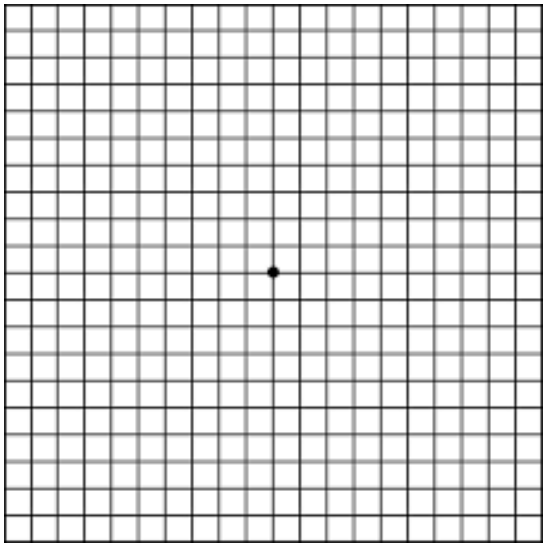
COMPLAINTS	NO OF PATIENTS	PERCENTAGE
CENTRAL SCOTOMA	44	73.3%
METAMORPHOPSIA	16	26.7%
TOTAL	60	100

FIGURE - 7

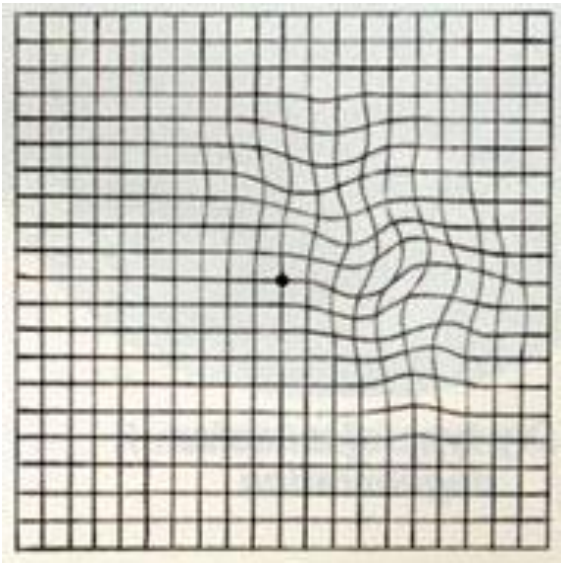


In our study group, 44% of patients gave history of a central scotoma while only 16% of patients were able to give a history of metamorphopsia. along with complaints of defective vision.

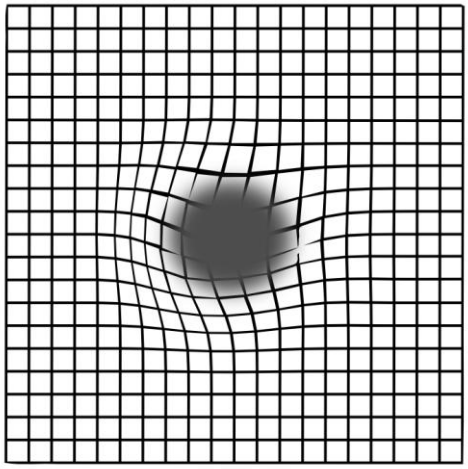
AMSLERS GRID



METAMORPHOPSIA



CENTRAL SCOTOMA

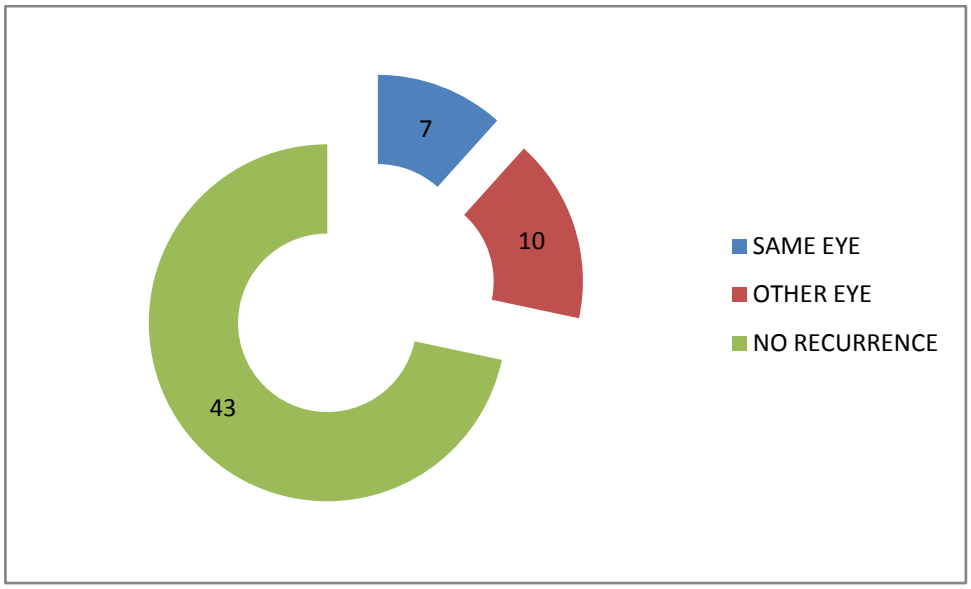


8. RECURRENCE OF CSR

TABLE 8

RECURRENCE	EYE	NO OF PATIENTS
YES	SAME EYE	7
	OTHER EYE	10
NO		43
TOTAL		60

FIGURE -8



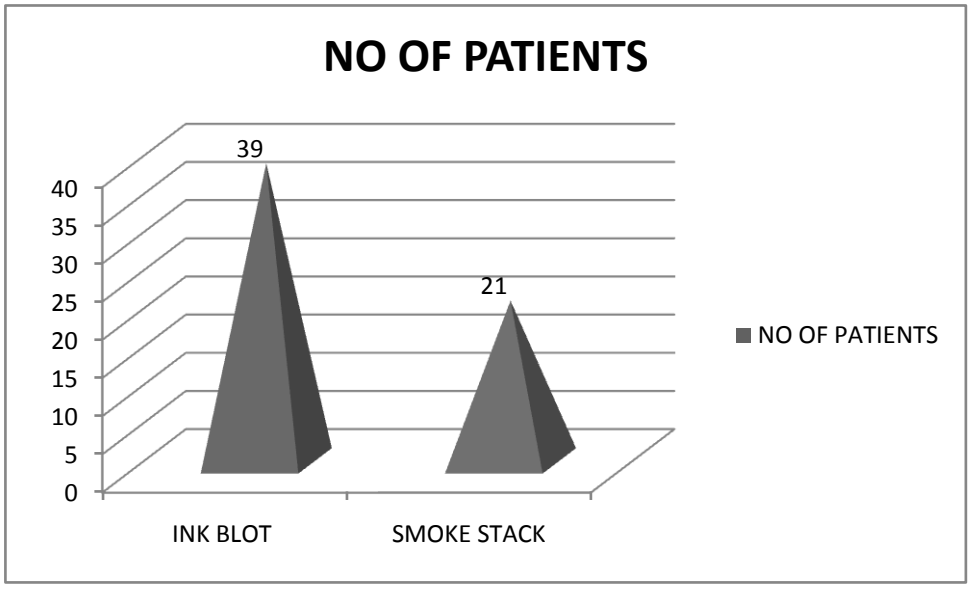
Among our 60 study subjects, 17 patients gave a previous episode of CSR among whom 7 patients had an episode in the same eye wheres as 10 patients had an previous history in the other eye. Remaining 43 patients had a persistent CSR lasting for more than 3 months.

9.FUNDUS FLUORESCEIN ANGIOGRAPHIC PATTERNS

TABLE 9

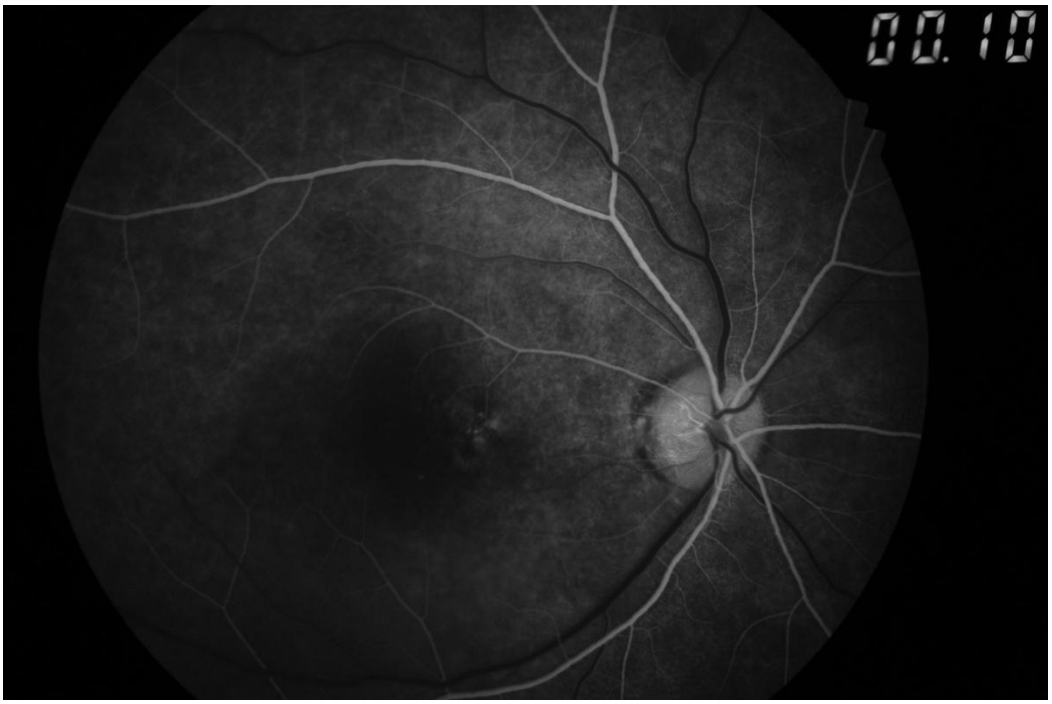
FFA PATTERN	NO OF PATIENTS	PERCENTAGE
INK BLOT	39	65
SMOKE STACK	21	35
RPE CHANGES	17	28.3
PED	15	25

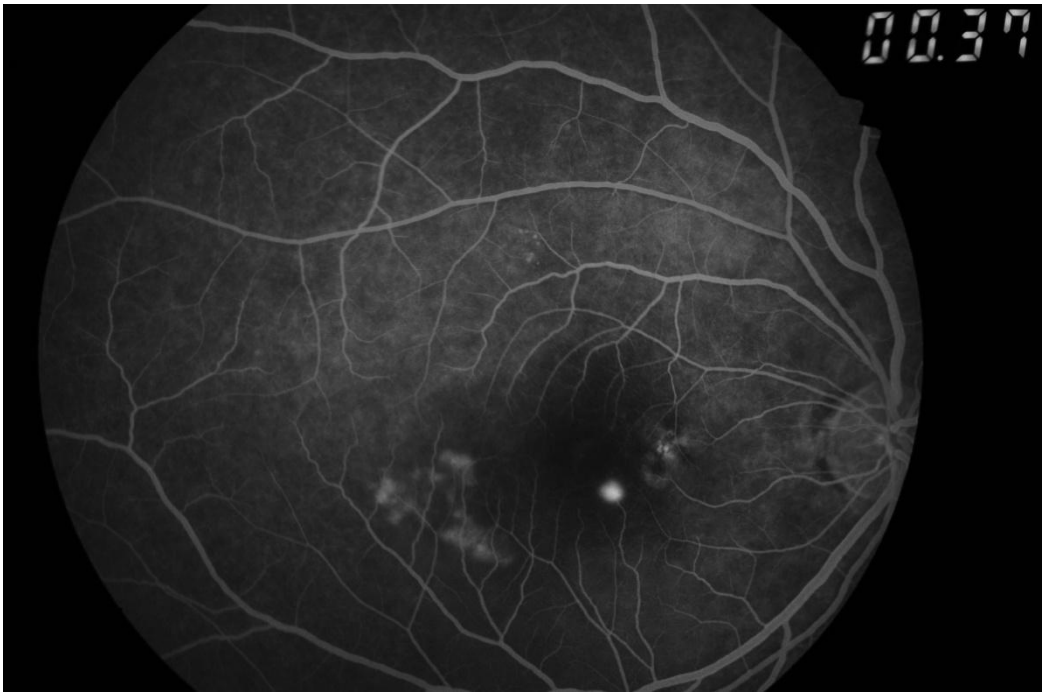
FIGURE 9



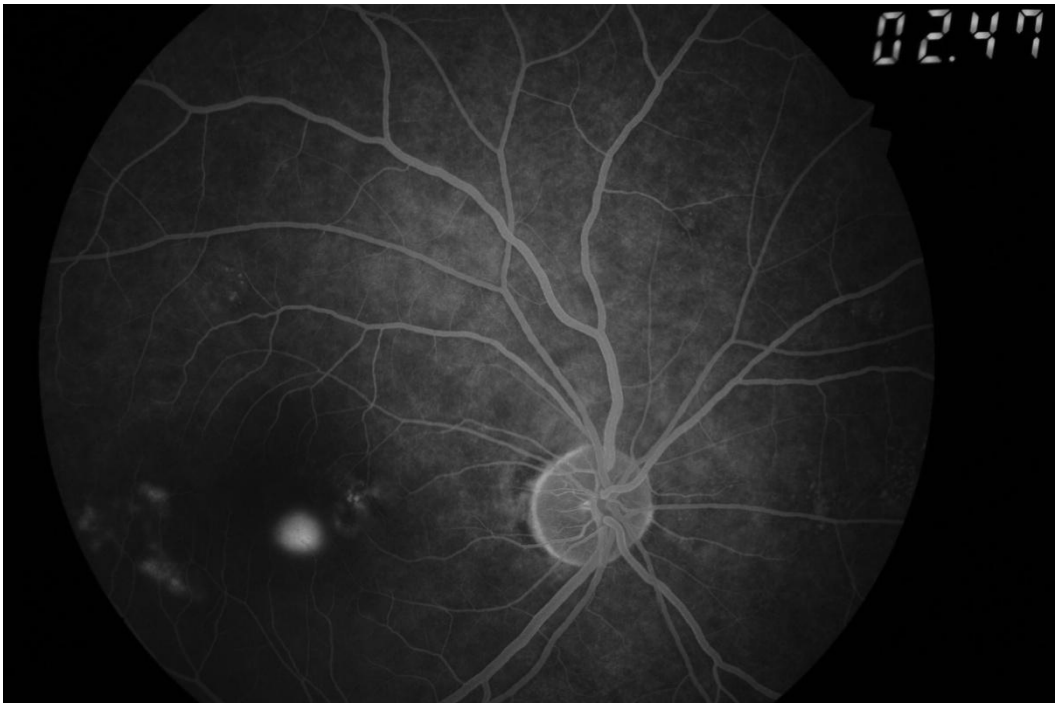
The commonest pattern in fluorescein angiography was the ink blot pattern, 65% while the remaining 35% of the patients had a smock stack pattern. The CSR was associated with PED in 25% of the patients. Retinal pigment epithelial changes and defects were seen in 28.3% of the patients. One patient had congenital hypertrophy of the retinal pigment epithelium (bear track appearance) associated with CSR.

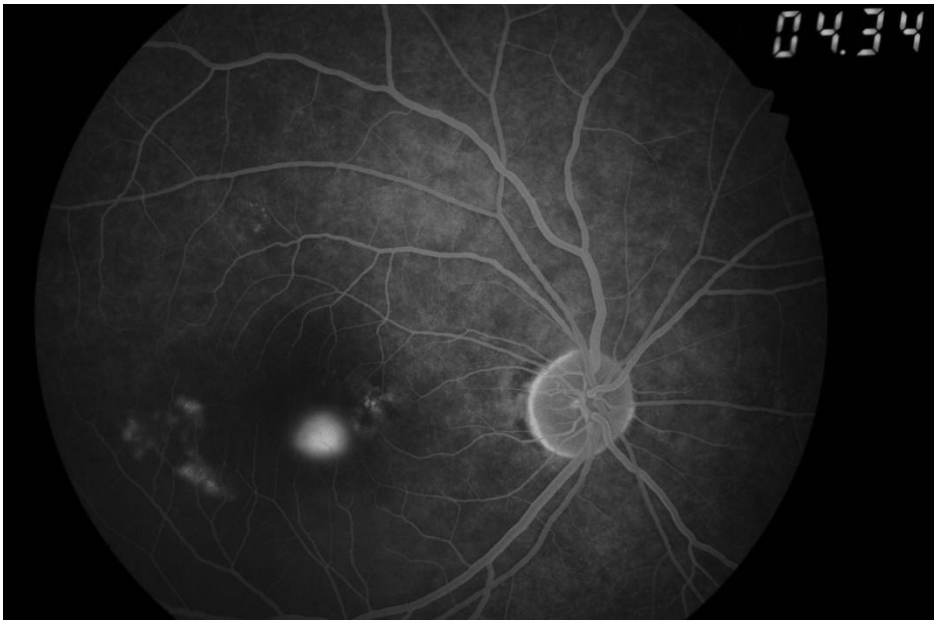
FUNDUS FLUORESCEIN ANGIOGRAPHY OF RIGHT 50 YEAR OLD PATIENT SHOWING INK BLOT PATTERN OF LEAKAGE



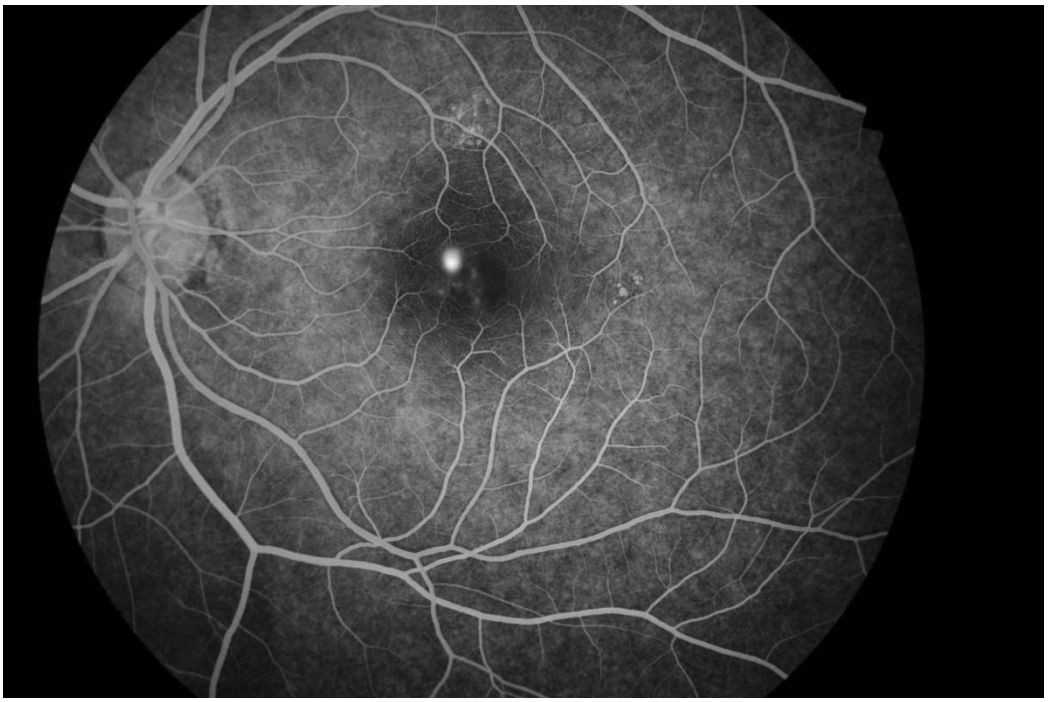


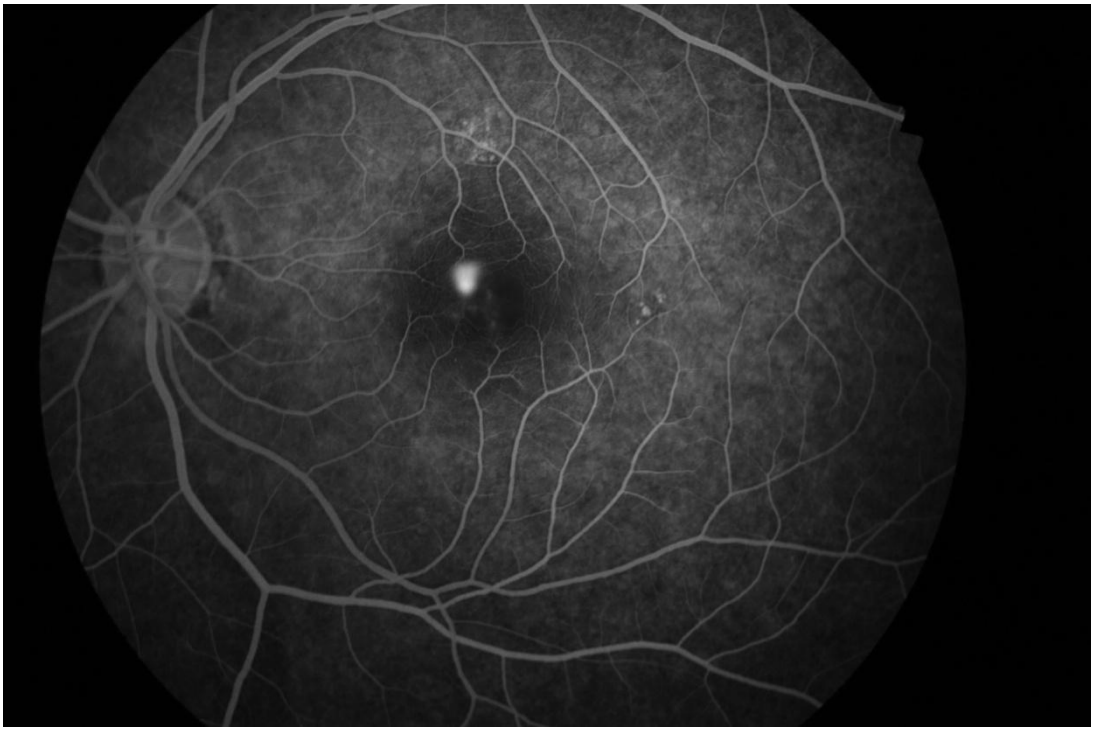
FUNDUS FLUORESCEIN ANGIOGRAPHY OF RIGHT EYE 50 YEAR OLD PATIENT SHOWING INK BLOT PATTERN OF LEAKAGE



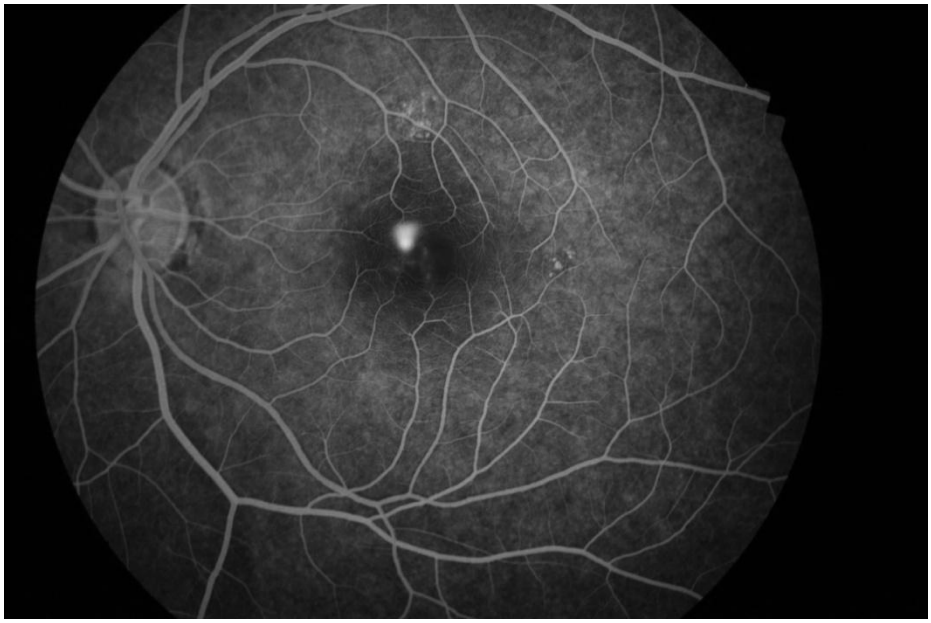


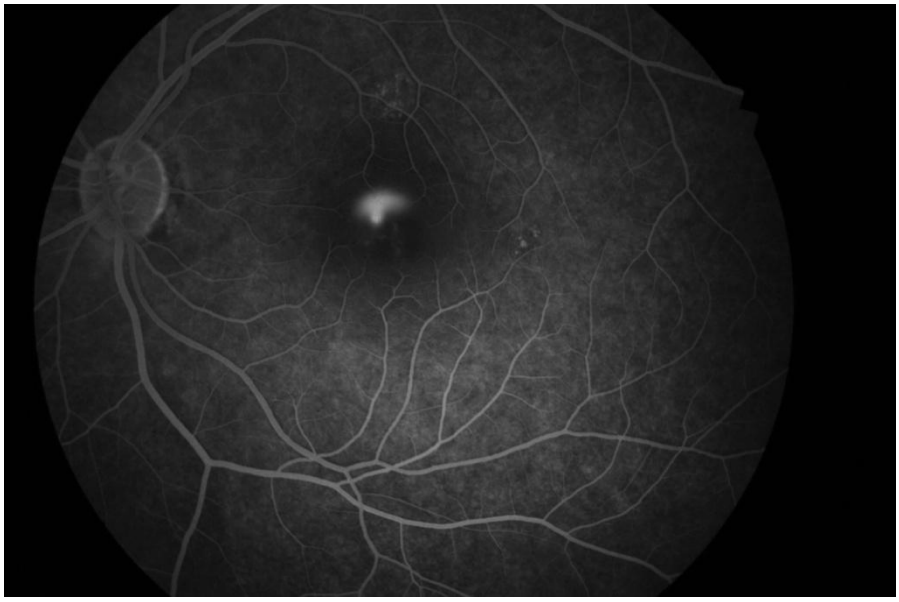
FUNDUS FLUORESCEIN ANGIOGRAPHY OF 39 YEAR OLD PATIENT SHOWING SMOKE STACK PATTERN OF LEAKAGE





FUNDUS FLUORESCEIN ANGIOGRAPHY OF 39 YEAR OLD PATIENT SHOWING SMOKE STACK PATTERN OF LEAKAGE



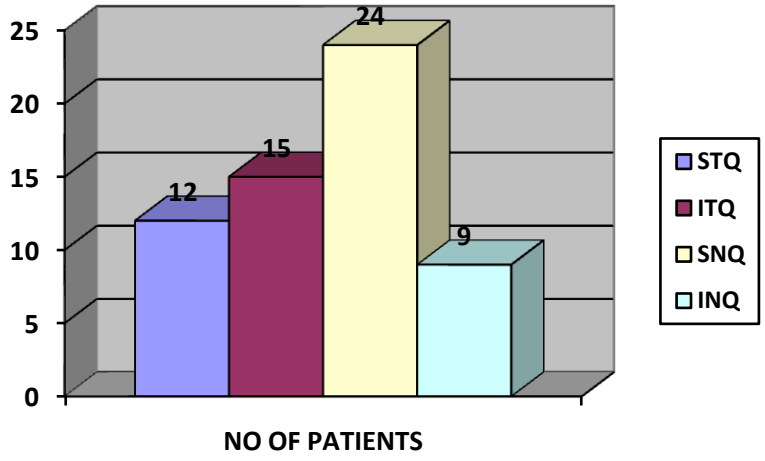


10.SITE OF LEAKAGE IN ANGIOGRAPHY

TABLE 10

SITE	NO OF PATIENTS	PERCENTAGE
STQ	12	20
ITQ	15	25
SNQ	24	40
INQ	9	15
TOTAL	60	100

FIGURE 10

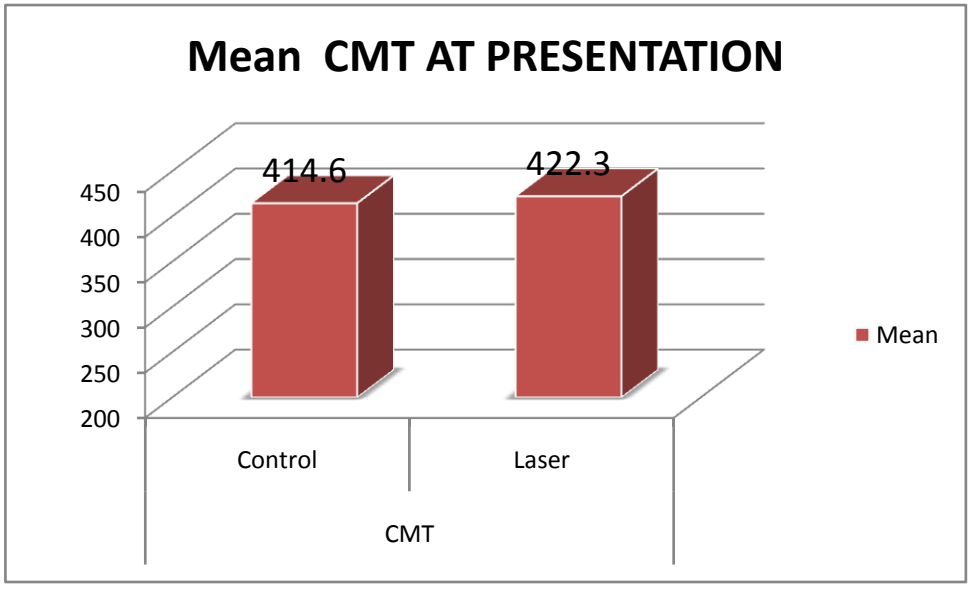


In our patients 40% of the patients had leakage in the superonasal quadrant, 25% of patients had leakage in the infero temporal quadrant. 20% of patients had leak in the superotemporal quadrant and 15% of patients had leak from the inferonasal quadrant. Patients with leakage in the foveal avascular zone were excluded from the study.

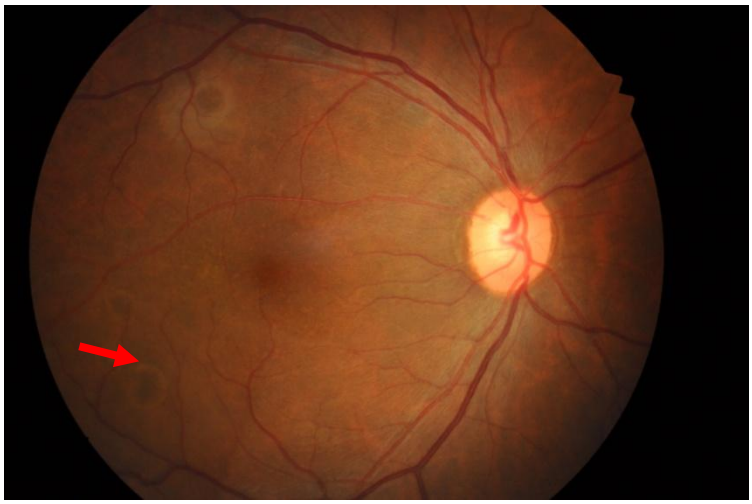
11. OPTICAL COHERENCE TOMOGRAPHY

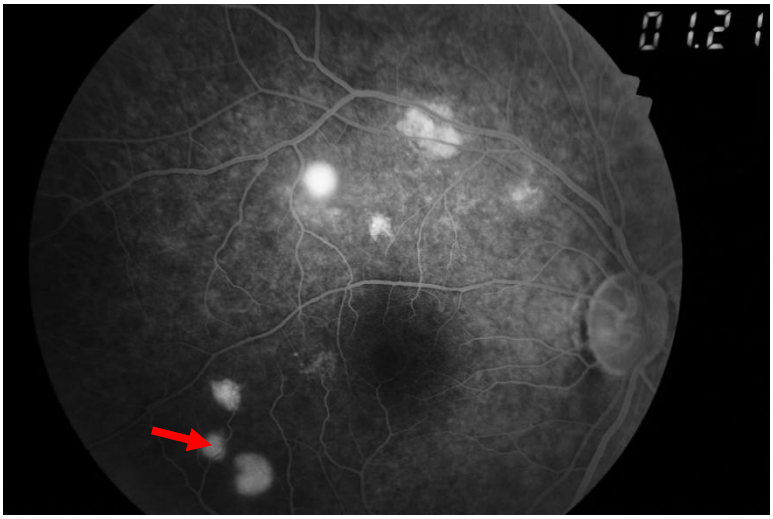
The mean central macular thickness of the control group at presentation was 414.6± 83.5µm and that of the laser group was 422.3±92.4µm. Pigment Epithelial Detachment was present in 40% of patients which corresponded with that of fundus fluorescein angiography.

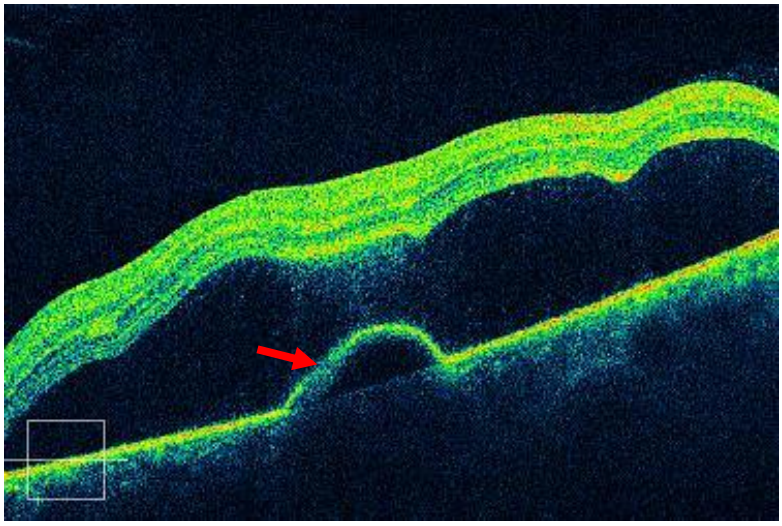
FIGURE - 11



FFA AND OCT OF A 40 YEAR OLD PATIENT WITH PIGMENT EPITHELIAL DETACHMENT (RED ARROW)







12. ANALYSIS OF EFFICACY OF FOCAL LASER

60 EYES OF 60 patients who were diagnosed as CSR by fundus flourescein angiography and OCT satisfying aforementioned criteria included in the study. The patients were assigned into two groups of 30 patients each by simple randomization.

- Group 1 was the observational group where the patients were observed over a period of 3 months. This served as the control group for our study.
- The patients in group 2 were the patients selected to undergo focal laser and served as the study group. These patients underwent focal laser wherein pinpoint leaks were treated with burns of spot size 100 µm, power of 100 mW of 100ms duration. The leaks were treated with 3 confluent burns. The visual acuity of the patients was recorded at 4 weeks and 12 weeks post laser. They also underwent OCT to look for the central macular thickness and resolution of subretinal fluid at 4 weeks and 12 weeks.

BASELINE PARAMETERS

- The mean central macular thickness of the control group at presentation was 414.6± 83.5µm and that of the laser group was 422.3±92.4µm.
- The mean visual acuity of the control group at presentation was 0.64 ±0.2 and that of the laser group was 0.6±0.15 at presentation (in logMAR).
- The control group was age and sex matched to the study group and was comparable to the study group in terms of visual acuity (p = 0.736) and central macular thickness (p= 0.188) with no statistical difference between the two groups by

independent t test at presentation.

TABLE 12

BASELINE	Group	N	Mean	Std. Deviation	Std. Error Mean	P value
CMT	Control	30	414.6000	83.46736	15.23899	0.736
	Laser	30	422.3000	92.36179	16.86288	
Vision	Control	30	.6400	.17734	.03238	0.188
	Laser	30	.5833	.15105	.02758	

FIGURE - 12

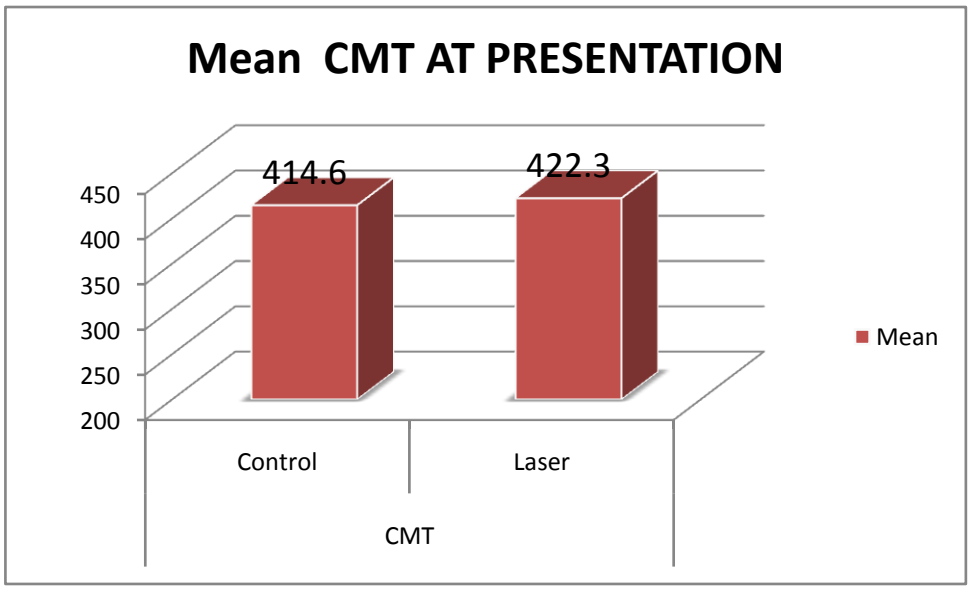
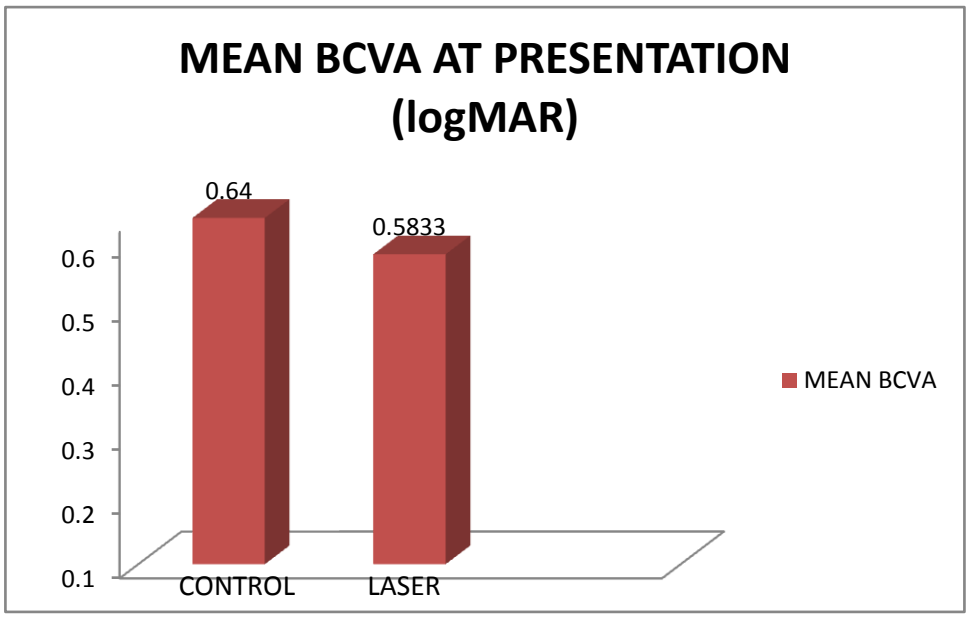


FIGURE - 13



The patients of the laser group were evaluated four months after the focal laser to the leakage points and the patients of the control group were evaluated after four months after their first presentation.

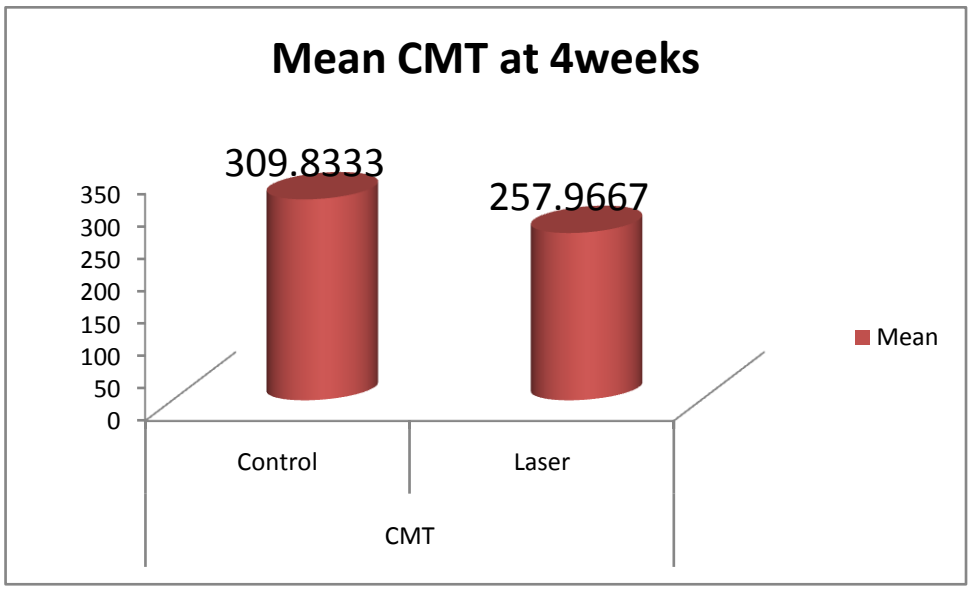
PARAMETERS AT 4 WEEKS

TABLE 13

4 weeks	Group	N	Mean	Std. Deviation	Std. Error Mean	p value
CMT	Control	30	309.8333	47.71473	8.71148	0.001
	Laser	30	257.9667	63.61061	11.61365	
Vision	Control	30	.4333	.21227	.03875	0.000
	Laser	30	.2000	.15757	.02877	

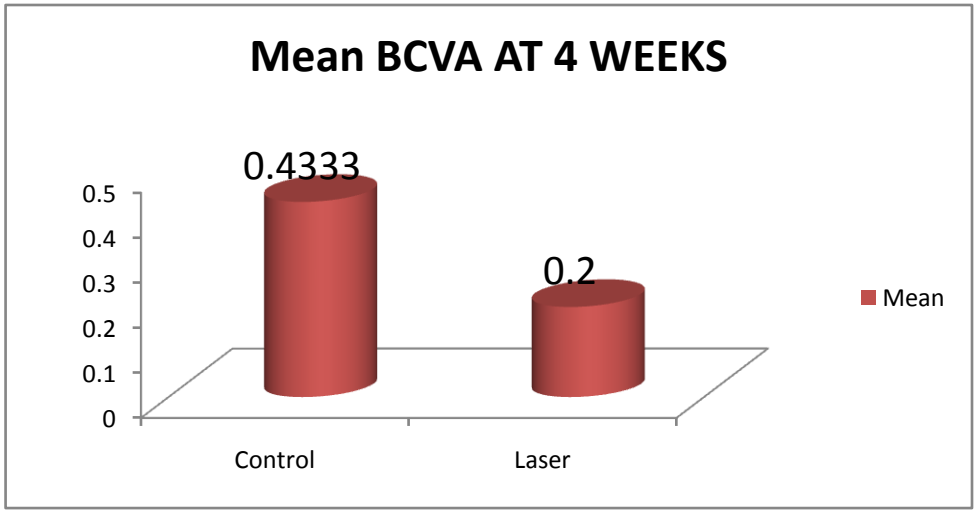
- The Central macular thickness of the control group at four weeks was 309.8±47.7 µm and that of the laser group was 257.9 ±63.6µm.
- There was a 25.3% decrease in the central macular thickness of the control group and and 38.3% decrease in the study group.
- The difference between the 2 groups at 4 weeks in terms of visual acuity ($p<0.01$) and CMT ($p<0.05$) was statistically significant. Though the difference between the baseline CMT and CMT at four weeks was significant for both groups ($p<0.01$) by paired T test, the percentage of decrease was more in the laser group when compared to the control group.

FIGURE 14



- The visual acuity of the control group at four weeks had a mean 0.43± 0.2 and the control group was 0.2±0.1. The difference in visual acuity between the baseline and at four weeks of the laser group was statistically significant by paired t test ($p<0.05$) whereas it was not statistically significant in the control group($p= 0.136$)

FIGURE 15



PARAMETERS AT 12 WEEKS.

TABLE 14

12 WEEKS	Group	N	Mean	Std. Deviation	Std. Error Mean	p value
CMT	Control	30	260.5667	38.07043	6.95068	0.000
	Laser	30	215.1000	22.08190	4.03159	
Vision	Control	30	.2167	.17436	.03183	0.001
	Laser	30	.0833	.11472	.02095	

- The mean central macular thickness of the study group was 260.6± 38 µm and that of the laser group was 215.1± 22 µm.
- The difference in the central macular thickness between the two groups was statistically significant ($p<0.01$)
- There was a 37.3% decrease in central macular thickness at 12 weeks from the baseline in the control group. This was statistically significant ($p<0.01$) by paired t test. The decrease in CMT of the laser group at 12 weeks was a 49% which was statistically significant ($p <0.01$).

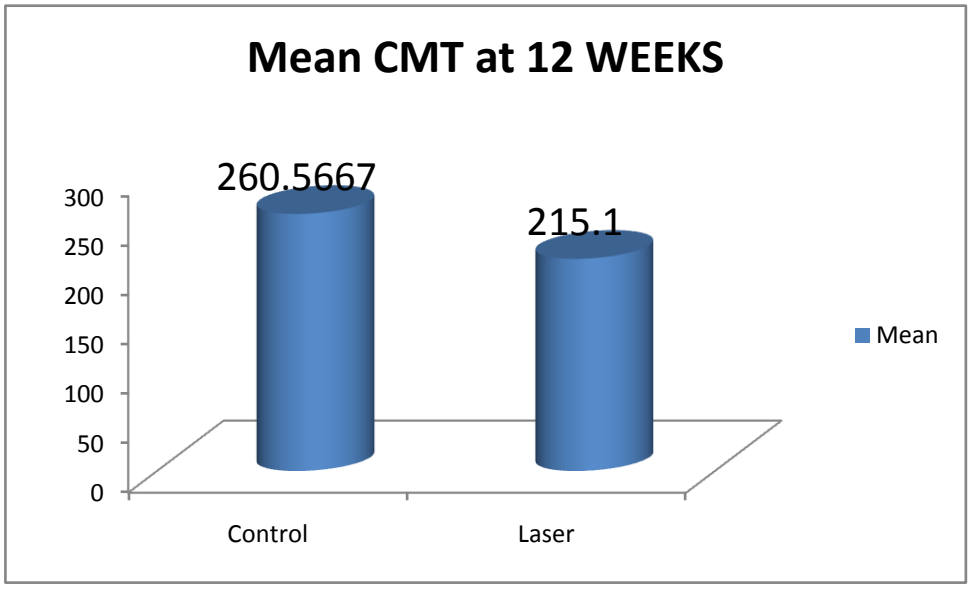


FIGURE 16

- The mean visual acuity of the control group was 0.21 ± 0.2 in logMAR whereas that of the study group was 0.1 ±0.2. The difference in visual acuity between both the groups was statistically ($p<0.05$). The improvement in visual acuity of both the laser group and the control group was statistically significant by paired t test ($p<0.01$).

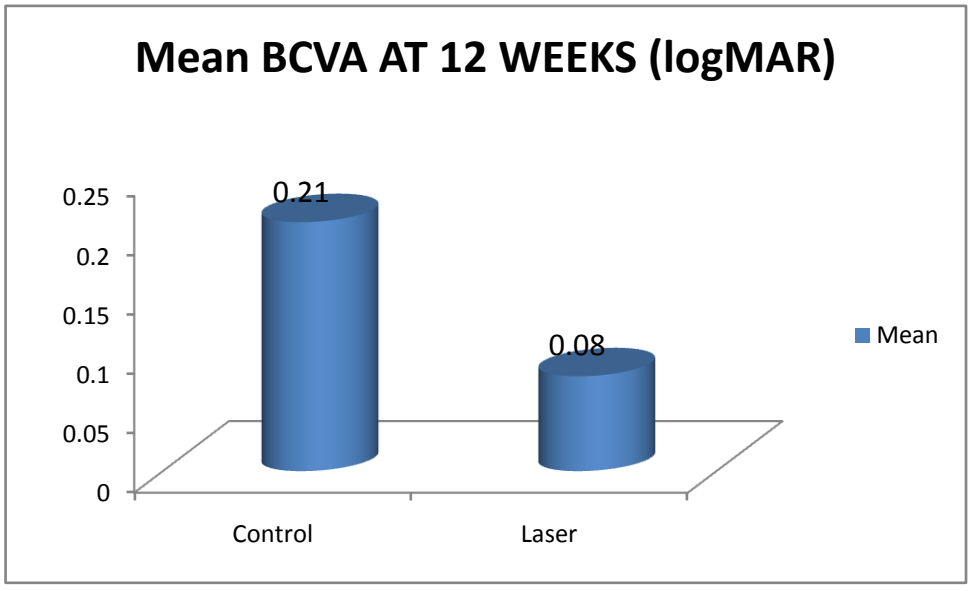


FIGURE 17

FIGURE 18- COMPARISON OF CMT OF LASER AND CONTROL GROUPS AT PRESENTATION AND AT 4 AND 12 WEEKS

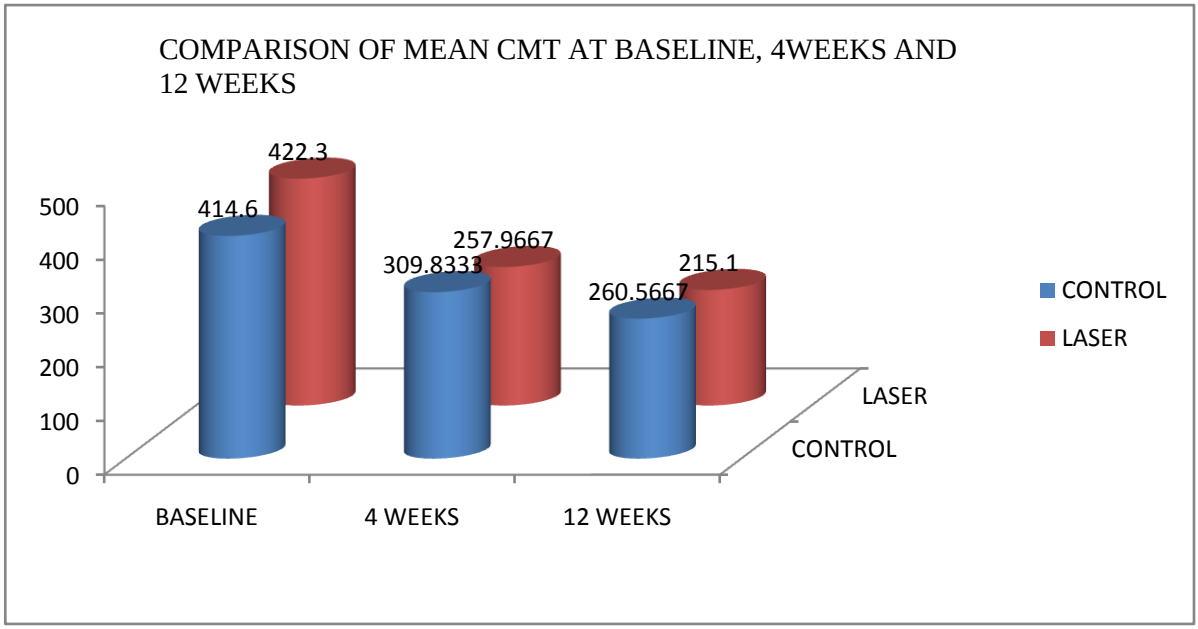
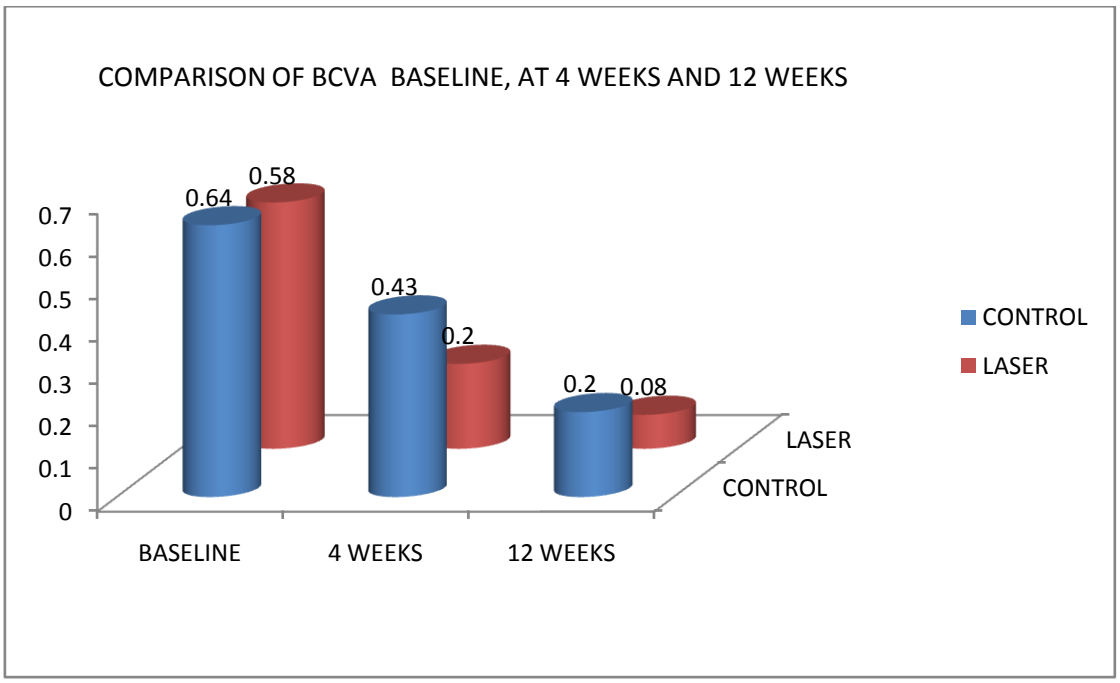


FIGURE 19- COMPARISON OF BCVA OF LASER AND CONTROL GROUPS AT PRESENTATION AND AT 4 AND 12 WEEKS



EFFECT SIZE ANALYSIS

Since the difference between the laser groups and control groups in terms of visual acuity and Central Macular Thickness is significant by paired t test, the effect size analysis is done to assess the usefulness of the intervention.

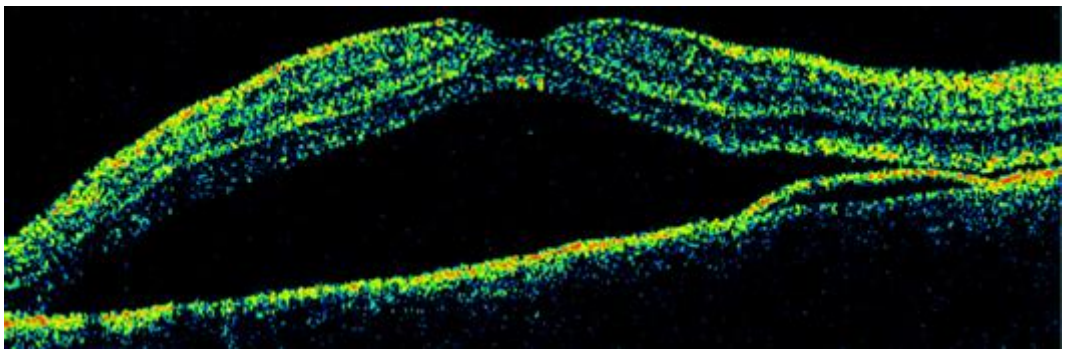
TABLE 15

GROUP	CMT		BCVA	
	COHEN d	**r**	**COHEN d**	**r**
CONTROL GROUP	2.37	0.76	2.52	0.78
LASER GROUP	3.08	0.84	3.80	0.88

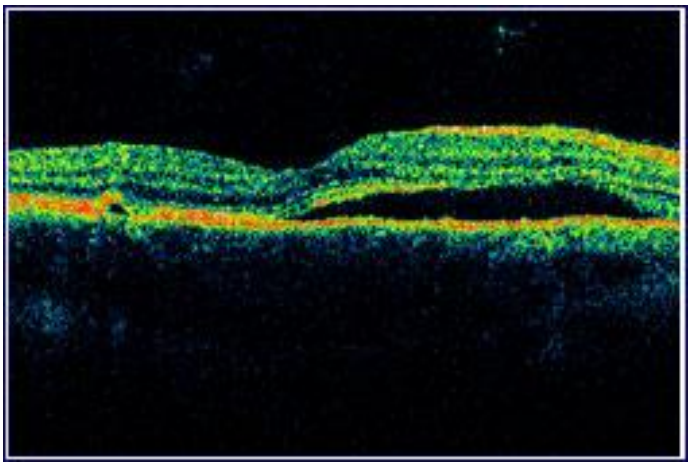
As depicted in the table the effect between baseline and the 12 months for CMT is 0.76 for the control group however the effect for the study group is 0.84. Similarly the r= 0.78 for the control group whereas it is 0.88 for the laser group. **This shows that the focal laser has a significant effect in the reduction of the central macular thickness and improvement in visual acuity when compared with the control group.**

FIGURE 20 – 28 YEAR OLD PATIENT FROM STUDY GROUP SHOWING RESOLUTION OF THE DETACHMENT

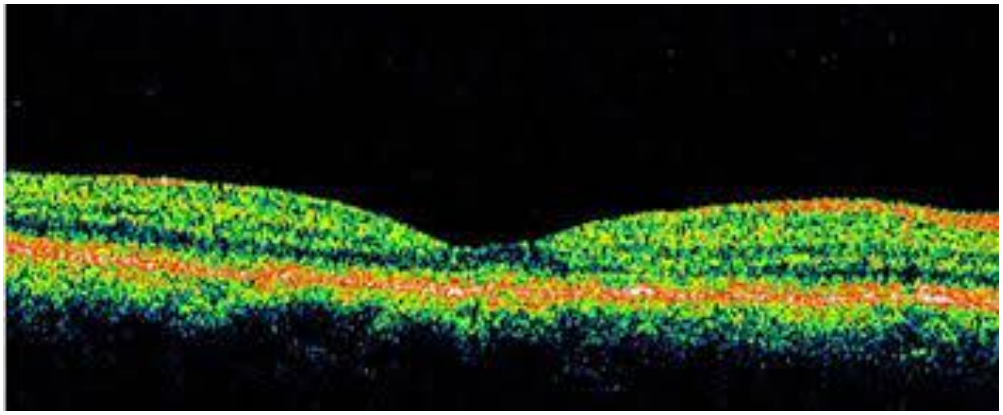
BASELINE



AT 4 WEEKS



AT 12 WEEKS



DISCUSSION

This study was conducted in the Uvea and Retina services of Regional Institute of Ophthalmology, Government Ophthalmic Hospital wherein 60 eyes of 60 patients diagnosed as CSR were included in the study.

1. AGE

The mean age in our study was found to be 38.7 years. The study conducted by Spaide et al and Tittl et al found the mean age to be 51 years in individuals with Central serous Chorioretinopathy[9,10]. The mean age in our study is lesser than these previous studies. This may be because of the increasing incidence of stress and other risk factors like hypertension and smoking in younger individuals.

2. SEX DISTRIBUTION

The male to female ratio in our study was found to be 2.75:1 with a male preponderance. The previous studies conducted also show a male preponderance up to a ratio of 6:1.[9,10] The increased incidence in male may be due to the increased prevalence of risk factors among males.

3. LATERALITY

Only 16.6% of the patients had bilateral CSR in our study group. Among the 10, patients 4 patients (40%) of patients have history of systemic steroid usage. Study conducted by EA Bouzas et al found steroids to cause bilateral, atypical CSR in patients and thus steroids should not be used in the treatment of CSR.

4. RISK FACTORS

Recent history of mental stress was found to be the commonest risk factors with 38.3% of the patients having the history. The next highest risk factor was type A personality with 28.3% of the patients having this

risk factor. Smoking was found in 26.7% of the patients compared to alcoholism which was found in 15% of the patients. 11.7% of the patients had hypertension and 8.5% of the patient had diabetes. History of steroid usage was found in 13.3% of the patients. This correlates to many risk factors cited by Haimovici et al. [16] there were no pregnant females in our study.

5. ASSOCIATON WITH STEROID USAGE

Among the 60 patients, only 13.3% of the patients had history of steroid usage. But in patients with bilateral CSR 50% of patients gave history of systemic steroid usage. Among them one patient who was on topical steroid had unilateral CSR. Therefore systemic steroid usage is a significant risk factor for bilateral CSR and in patients with bilateral condition this history should be asked for and patients should be asked to stop steroid and be put on other steroid sparing agents as per the requirements of the disease condition.[19]

Study conducted by EA Bouzas et al found steroids to cause bilateral, atypical CSR in patients and thus steroids should not be used in the treatment of CSR.

6. PRESENTING COMPLAINTS

73% of the patients complained of a central scotoma on presentation while 27% of the patients were able to appreciate metamorphopsia along with complaints of defective vision.

7.RECURRENCE OF CSR

Among our study population, 28.3 % of patients had previous history of CSR suggesting recurrence. 7 patients had an episode in the same eye wheres as 10 patients had an episode in the other eye. This corresponds to the Wilmer Retinal Vascular Centres study of CSR which documented

a recurrence rate between 30% - 33%.[31]

8. FUNDUS FLUORESCEIN ANGIOGRAPHIC PATTERNS

The ink blot pattern was present in 65% of our patient with the smock stack pattern being present in only 35% of the patients. 25% patients had an associated pigment epithelial detachment with retinal pigment epithelial changes being present in 28.3% of the patients. The leaks were found to be more common in the superonasal quadrant in our study, with 40% of patients having leakage at this site. Patients with foveal leakage were excluded from our study.

The study conducted by Shahin MM showed 35% of patients had multifocal leaks. The commonest site of leak was the macula in 79% of patients. Extrafoveal leakage was seen in 14% of patients and peripapillary leakage was seen in 12% of patients. The inkblot pattern was found in 53% of patient with RPE atrophic changes in 84% of the patients.[28]

9. OPTICAL COHERENCE TOMOGRAPHIC ASSESSMENT

The mean central macular thickness of the control group at presentation was 414.6± 83.5µm and that of the laser group was 422.3±92.4µm.Pigment Epithelial Detachment was present in 40% of patients which corresponded with that of fundus fluorescein angiography. There was no evidence of Choroidal Neovascularisation Membrane in any patients at the time of presentation.

Two distinct pattern of OCT findings have been documented in previous studies.[29] An optically empty elevated area of variable dimensions can be seen which corresponds to fundus flourescein angiography. Highly

characteristic small bulges could be observed protruding from the retinal pigment epithelium corresponding to the leaking spots in fundus flourescein angiography. In the other variant, semicircular spaces beneath under the RPE with retinal thinning can be seen.

10.ANALYSIS OF THE EFFICACY OF FOCAL LASERS

In our study we documented a significant decrease in the central macular thickness at 4 weeks and 12 weeks post laser where the central macular thickness reduced by 38.3% at four weeks and 49% at 12 weeks which was statistically significant ($p<0.001$) when compared with the control group. In the control group the central macular thickness reduced only by 25.3% at 4 weeks and 37.3% at 12 weeks. There was also a significant improvement in the visual acuity at 4 weeks and 12 weeks in the laser group which was statistically significant when compared with the control group ($p<0.01$). No side effects of laser were documented in our study subjects during the study period.. Therefore this shows that laser treatment reduces the duration of the CSR along with a significant improvement in visual acuity. In a study conducted by Robertson et al, showed that direct laser photocoagulation reduced the central macular thickness and significantly reduced the duration of CSR when compared to patients undergoing sham laser and reduces the recurrences of CSR.[30] while the study conducted by Ficker and colleagues showed that Argon laser does not reduce the recurrences of CSR which may develop due to leakage in sites other than the previously lasered site in the retina.[31]

CONCLUSION

1. Focal lasers are effective in cases of central serous chorioretinopathy which persists for a period of more than three months. Focal lasers can be used effectively to shorten the duration of the disease and results in the resolution of the subretinal fluid and improvement in visual acuity significantly by 4 weeks.
2. Mental stress, type A personality and sleep disorders are found to be significant risk factors in patients with CSR in our study.
3. Systemic steroid usage is found to be a significant risk factor in patients with bilateral CSR.
4. The most common site of extrafoveal leakage in fundus flourescein angiography in our study was found to be in the superonasal quadrant. (40%).
5. The ink blot pattern was found to be most common pattern in fundus flourescein angiography (present in 65% of the patient).
6. CSR was found to be associated with Retinal Pigment Epithelial detachment in 25% of the patients by FFA and OCT

FUTURE PROSPECTS

1. To study the long term effects of lasers in patients who underwent focal lasers in terms of side effects like Scotoma and Choroidal neovascularization.
2. To assess the frequency of recurrence of CSR in patients who underwent lasers when compared with a control group.

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PROFORMA

Name : **Age :** **Sex:**

OP NO:

Address and phone number:

Occupation:

Night shifts:yes/no

Complaints:defectivevision/scotoma/metamorphopsia/microps ia/headache/ others

History: past eye illness/ similar episode/ duration of recurrence

Personal history: Mental stress/ Allergy/ Smoking/ Drug intake/ History of steroid intake/

Systemic illness/ h/s/o type A Personality

Medical/Surgical History:

EXAMINATION OF EYE:

Visual Acuity	RE	LE
Tension		
Fields		
AR/Subjective		
Slit Lamp Examination		
Fundus Examination Direct Ophthalmoscopy 90D IDO		
Amslers Grid		
Fundus Flouresce in Angiography Pattern Site of Leak FAZ Others		

Optical Coherence Tomography Central Macular thickness Subretinal Fluid PED- yes/no		

GENERAL EXAMINATION : CVS
RS
CNS
P/A

INVESTIGATIONS:

TREATMENT: Laser / placebo group

Spot Size	
Number of burns	
Duration	
Power	

Follow UP

Visual acuity	4 WEEKS	12 WEEKS
AR/ Subjective		
Tension		
Amslers Grid		
Central Foveal Thickness		
Sub retinal fluid		

KEY TO MASTERCHART

BCVA	- Best Corrected Visual Acuity

RISK FACTORS

N.S. / S.D.	- Night Shift/ Sleep Disturbance
ALC/ SMOKER	- Alcoholic/ Smoker
DM/ HTN	- Diabetes Mellitus/ Hypertension
T.A.P	- Type A Personality
M.S.	- Mental stress
S.U.	- Steroid Usage

AMSLERS GRID

C.S.	- Central Scotoma
MM	- Metamorphopsia

PREVIOUS ATTACK

S.E.	- Same Eye
O.E.	- Other Eye
FFA	- Fundus Fluorescein Angiography
D.C.F.	- Delayed Choroidal Filling
I.B.P.	- Ink Blot Pattern
S.S.P	- Smoke Stack Pattern
RPE C	- Retinal Pigment Epithelial Changes
PED	- Pigment Epithelial Detachment

SITE OF LEAK

STQ	- Superotemporal Quadrant
ITQ	- Inferotemporal Quadrant
SNQ	- Superonasal Quadrant
INQ	- Inferonasal Quadrant
OCT	- Optical Coherence Tomography
CMT	- Central Macular Thickness
CNVM	- Choroidal Neovascular Membrane
S.G.	- Study Group
1	- Control Group
2	- Laser Group