A Dissertation on

"A COMPARATIVE STUDY OF LOGMAR CHART VISUAL ACUITY WITH SNELLENS CHART VISUAL ACUITY IN A DIABETIC POPULATION WITH AND WITHOUT MACULOPATHY"

Submitted to

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GOVT. STANLEY MEDICAL COLLEGE

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI – 600 001

MAY 2022

CERTIFICATE

This is to certify that the study entitled **"A COMPARATIVE STUDY OF LOGMAR CHART VISUAL ACUITY WITH SNELLENS CHART VISUAL ACUITY IN A DIABETIC POPULATION WITH AND WITHOUT MACULOPATHY"** is the result of original work carried out by **DR.RAMYA.M** under my supervision and guidance at **GOVT. STANLEY MEDICAL COLLEGE, CHENNAI**. The thesis is submitted by the candidate in partial fulfilment of the requirements for the award of **M.S Degree in OPHTHALMOLOGY**, a course from 2019 to 2022 at Govt. Stanley Medical College, Chennai.

Prof. Dr. K VINAYAGAMURTHY M.S.,
Unit Chief & Professor of Ophthalmology,
Govt. Stanley Medical College,
Chennai – 600001.

Prof. Dr.THANGERANI RAAJASEHARAN M.S, D.O.,
Head of the Department,
Govt. Stanley Medical College & Hospital,
Dept. of Ophthalmology,
Chennai – 600001.

PROF. Dr. P. BALAJI MS, FRCS, Ph.D, FCLS
Dean
Government Stanley Medical
College Chennai - 600001

CERTIFICATE FROM GUIDE

This is to certify that the dissertation entitled "**A COMPARATIVE STUDY OF LOGMAR CHART VISUAL ACUITY WITH SNELLENS CHART VISUAL ACUITY IN A DIABETIC POPULATION WITH AND WITHOUT MACULOPATHY"** is a bonafide record of research work done by **DR.RAMYA.M,** Post Graduate Resident in Department of Ophthalmology, Government Stanley Medical College, Chennai.

Prof. Dr. K VINAYAGAMURTHY M.S.,
Unit Chief & Professor of Ophthalmology,
Govt. Stanley Medical College,
Chennai – 600001.

DECLARATION

I hereby declare that this dissertation entitled **"A COMPARATIVE STUDY OF LOGMAR CHART VISUAL ACUITY WITH SNELLENS CHART VISUAL ACUITY IN A DIABETIC POPULATION WITH AND WITHOUT MACULOPATHY"**is a bonafide and genuine research work carried out by me under the guidance of **Prof. Dr. K VINAYAGAMURTHY M.S.,** Unit Chief & Professor of Ophthalmology, Department of Ophthalmology, Government Stanley Medical College And Hospital,

Chennai - 600001.

Date:

Place: Chennai

Signature

(Dr. RAMYA. M)

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INSTITUTIONAL ETHICS COMMITTEE

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PRINCIPAL INVESTIGATOR : DR M. RAMYA,
DESIGNATION : PG IN OPHTHALMOLOGY,
DEPARTMENT : DEPARTMENT OF OPHTHALMOLOGY,
GOVT. STANLEY MEDICAL COLLEGE.

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4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
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Analysis address	dr.m.ramyamohan.mgrmu@analysis.urkund.com

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CERTIFICATE - II

This is to certify that this dissertation work titled "**A COMPARATIVE STUDY OF LOGMAR CHART VISUAL ACUITY WITH SNELLENS CHART VISUAL ACUITY IN A DIABETIC POPULATION WITH AND WITHOUT MACULOPATHY**" of the candidate **DR. RAMYA. M**with registration number **221913056** for the award of **M.S DEGREE** in the branch of **OPHTHALMOLOGY**. I personally verified the urkund.com website for the purpose of plagiarism Check. I found that the uploaded thesis file contains from introduction to conclusion pages and the result shows 17% of plagiarism in the dissertation.

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Introduction

INTRODUCTION

Diabetes mellitus is a common global health problem among adults raising at an alarming rate. The international Diabetes federation report states that the prevalence of diabetes among adults in roll is 8.3%, which has increase to 9.9% by 2030 [1].

The goal is to attain good glycemic control with reduced risk of macro and micro viscular complication of diabetes [2].

The values of glycated hemoglobin [HBA1C] is the gold standard assessments for glycomic control in world wide [3].

More than 50% of people having poor glycemic control with with diabetic vascular complications [4]. the reason for poor glycemic is lack of pharmacological and non pharmacological prescriptions.

VISION AND DIABETES:

The visual acuity in diabetic population has direct relation to glycemic control. Retinopathy is mostly asymptomatic in its most treatable stage. Delay in diagnosis results in significant increase in patients risk of visual loss. Around 90-95% diabetic cases belongs to type II DM. In type I diabetes who are youner and more likely to live long could benefit from tight glycemic control than patients with type II DM.

Some co existent diseases like hypertension, nephropathy, dyslipidemia have delayed benefit of glycemic control. Ocular condition is also an indicator of metabolic control of disease process.

Visual Acuity and Various Parameters:

Vision is one of the most important senses. The measurement of vision is the primary outcome & plays a vital role in our ability to perform daily tasks such as driving. This measurement of visual acuity is crude. It is used to measure both disease and change. visual acuity measures the treatment response also.[7,8]

Ascertaining vision is influenced by various factors, including light intensity, number, size, contrast, shape of optotypes, design of test chart and other external variables include age, gender, literacy level and duration of disease process. the choice of the chart should not influence the outcome of the vision measurement. [6,7,8]

The Snellen chart has historically being most popular in day today practice, it is widely used in all the outpatient department services. Though it has considerable flaws , the results of visual outcome is almost the same to that of LOGMAR charts.[7] Unfortunately, Snellen chart are also the „standard" in most retrospective case series and medicolegal decisions. In this areas, shortcomings of the Snellen chart do not allow appropriate quantification of vision. In contrast, the LOGMAR charts allow precise quantification of vision and reliable measures of vision change.[7]

ANATOMY OF RETINA:

The retina is the innermost coat of the eye. It extends from the optic disc to the oraserrata. It can broadly be divided into two distinct regions:

Posterior pole and **Peripheral retina** separated by the retinal equator. The *Retinal equator* is an imaginary line lying in line with the exit of the four vortex veins. The ***Posterior pole*** refers to the area of the retina posterior to the retinal equator. It includes two distinct areas: the optic disc and the macula lutea.

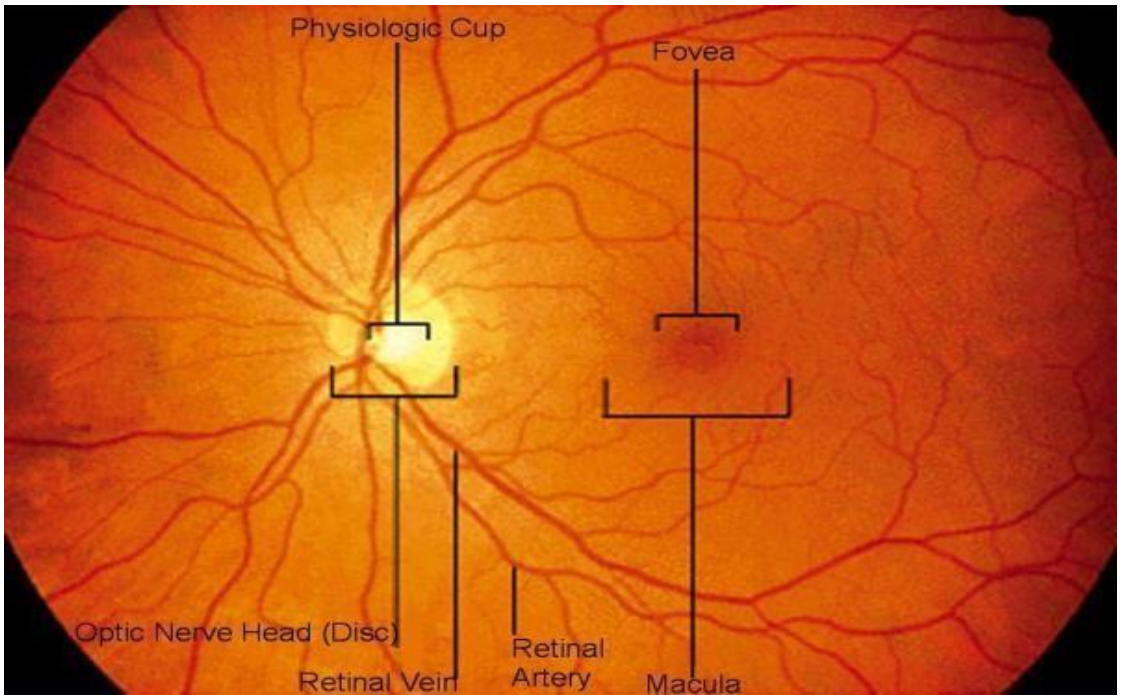
Posterior pole of the retina is best examined by the slit-lamp Indirect Biomicroscopy using a +78D or +90D lens and direct ophthalmoscopy.

The Optic disc*:* It is a pink coloured, well-defined circular area of 1.5 mm diameter. At the optic disc all the retinal layers terminate except the nerve fibres, which pass through the lamina cribrosa to run into the optic nerve(second cranial nerve). A depression seen in the optic disc is called the *physiological cup*. The central retinal artery and the central retinal vein emerge through the centre of this cup.

The Macula: The macula lutea is also called the *yellow spot*. It is relatively deeper red than the surrounding retina and is situated at the posterior pole temporal to the optic disc. It is about 5.5 mm in diameter. The *Foveacentralis* is a central depressed part in the macula. It is about 1.5 mm in diameter and is the most sensitive part of retina. In its centre is a shining pit called *foveola*(0.35 mm diameter) which is situated about 2 disc diameters 3mm) away from the temporal margin of the optic disc and about 1 mm below the horizontal meridian. An area

of 0.8 mm size (which includes foveola and some surrounding area) does not contain any retinal capillaries and is called the FOVEAL AVASCULAR ZONE (FAZ). Surrounding the fovea are the parafoveal and perifoveal areas.

Peripheral retina refers to the area bounded posteriorly by the retinal equator and anteriorly by the oraserrata. Peripheral retina is best examined with indirect ophthalmoscopy or Goldman three mirror contact lens.



The retina contains at least 10 distinct layers. They are from outer to inner:

(1) the retinalpigment epithelium

(2) the layer of rods and cones (photoreceptor layer)

(3) the external limiting membrane

(4) the outer nuclear layer

(5) the outer plexiform layer

(6) the inner nuclear layer

(contains the bipolar, amacrine and horizontal cells and nuclei of the fibres of Muller)

(7) The inner plexiform layer

(8) The ganglion cell layer

(9) The nerve fibre layer

(1) The internal limiting membrane

Approximately 10% of diabetic population as type I DM diagnosed before the age of forty years. The majority of patients have type II DM diagnosed at the age of forty years [30].

CONDITIONS THAT MAY AFFECT THE COURSE OF DIABETIC RETINOPATHY:

- Hypertension [34]
- Elevated triglycerides.Cardio vascular diseases.
- Cardio vascular diseases
- Proteinuria

DYSLIPIDAEMIA IN DIABETICS:

Hyperglycemia can result in cell damage by the following pathways:

- polyol pathway,
- upregulation of hexosamine pathway,
- advanced glycation end product (AGE) with increased expression of AGE receptors
- activation of protein kinase C (PKC) isoforms.

However, the corelation between traditional lipid markers and Diabetic Retinopathy remains unclear. Of all the hyperglycemia associated pathways, the protein kinase C (PKC) and Advanced Glycation Endproduct(AGE) pathways

interact with blood Lipids. Protein kinase C (PKC) is a family of 10 enzymes, in which the 1/2 isoform appears to be closely associated with the development of Diabetic Retinopathy. Hyperglycemia results in an increase in glucose flux through the glycolysis pathway, that increases the de novo synthesis of Diacylglycerol (DAG), the main activator of PKC in physiology. Moreover, the accumulated long-chain Fatty Acids are immediately converted into DAG. The expression of the PKC 1/2 isoform is increased in patients with diabetes mellitus. As PKC is involved in numerous physiological pathways, its upregulation contributes to the pathogenesis of Diabetic Retinopathy in the form of differential synthesis of extracellular matrix (ECM) proteins and their remodeling, increased release of angiogenic factors, endothelial and leukocyte dysfunction resulting in capillary occlusion and leukostasis, and eventually changes in the blood flow to retina.

Advanced Glycation Endproducts(AGEs) are generated by nonenzymatic reaction between reducing sugars and lipoproteins. Advanced Glycation End products are formed at a slow and constant rate in the normal body starting at embryonic development and accumulated over time. However, the formation of AGE is markedly increased in diabetes due to the increased availability of glucose. In a highly oxidative environment like retina, the accumulation of lipid and modification of proteins will lead to an accumulation of lipoxidation end products (ALEs).

There are two kinds of AGEs related to the pathogenesis of DR:Carboxy-ethyl-pyrrole and malon-di-aldehyde (MDA). Advanced Glycation Endproducts (AGE)s are important pathogenic mediators which can lead to a lot complications in Diabetes. They are seen in the retinal vessels of diabetics, and their levels correlates with those in serum and with the severity of the Diabetic retinopathy. The interaction of AGEs with specific cell surface receptors has been postulated in the onset of Diabetic Retinopathy. The AGE receptors include RAGE, galectin-3, CD36, and macrophage scavenger receptor. It is believed that exposure to high levels of Advanced Glycation End products (AGE)s leads to renal and vascular complications. In a study done by Hammes *et al*., the retinal capillaries showed an increased expression of AGEs and loss of pericytes 26 weeks after the development of diabetes in rats. Treatment with an AGE inhibitor, aminoguanidine (pimagedine) hydrochloride, significantly reduced AGE accumulation and prevented the rapid development of microaneurysms, pericyte loss and acellular capillaries

CLASSIFICATION OF DIABETIC RETINOPATHY:

Duke-elder et al first classified diabetic retinopathy.

Modern ETDRS classification (early treatment diabetic retinopathy study) developed

NON PROLIFERATIVE DIABETIC RERINOPATHY:

A. MILD NPDR

Atleast one microaneurysm . Definition not met with B, C, D, E, F.

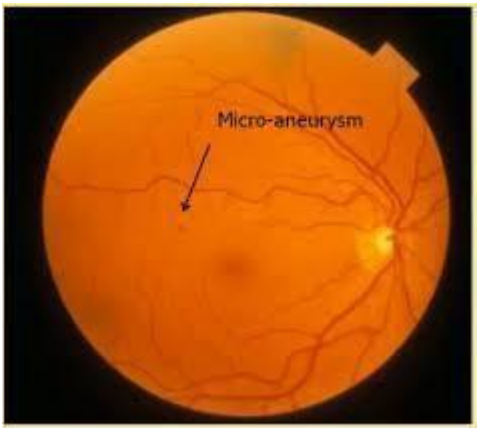
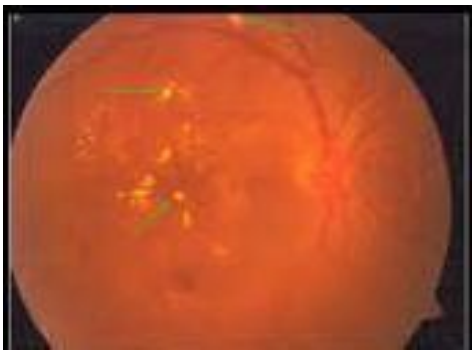
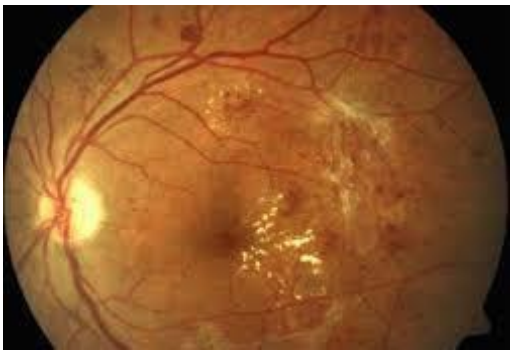
B. MODERATE NPDR

Hemorrhages and /or microaneurysms and or soft exudates, venous beading.

C. SEVERE NPDR: Hemorrhages and/or, microaneurysms in all four quardrants. Venous beading in two or more quardrants, IMRA more than in atleast one quadrant.

D. VERY SEVERE NPDR:

E. Any two or of c. Definition not met with E, F

Mild NPDR	Moderate NPDR
 **Microaneurysms only**	 **More than just Microaneurysms butless than severe nonproliferative diabetic retinopathy**
Serve NPDR	**Proliferative DR (PDR)**
 Any of the following 20 intraretinal hemorrhages ineach of 4 quadradantsOR Definite venous beading in2+ quadrantsOR Prominent IRMA in 1+ quadrantand noPDR	 1 or more of Neovascularisation Vitreous/ preretinalhemorrhage

4 quadrants VENOUS BEADING

1 quadrant IRMA (STD 8A)

Any of these situations – SEVERE NPDR

PROLIFERATIVE DIABETIC RETINOPATHY:

A. EARLY PDR:

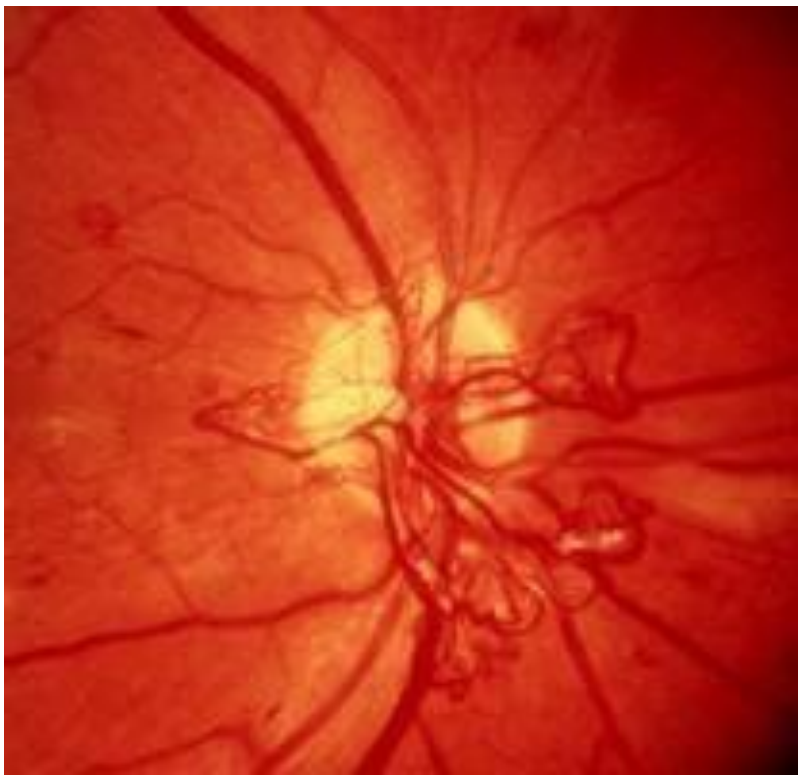
Presence of two new vessels, definition not met with F.

B. High risk of PDR: (Any one of the following)

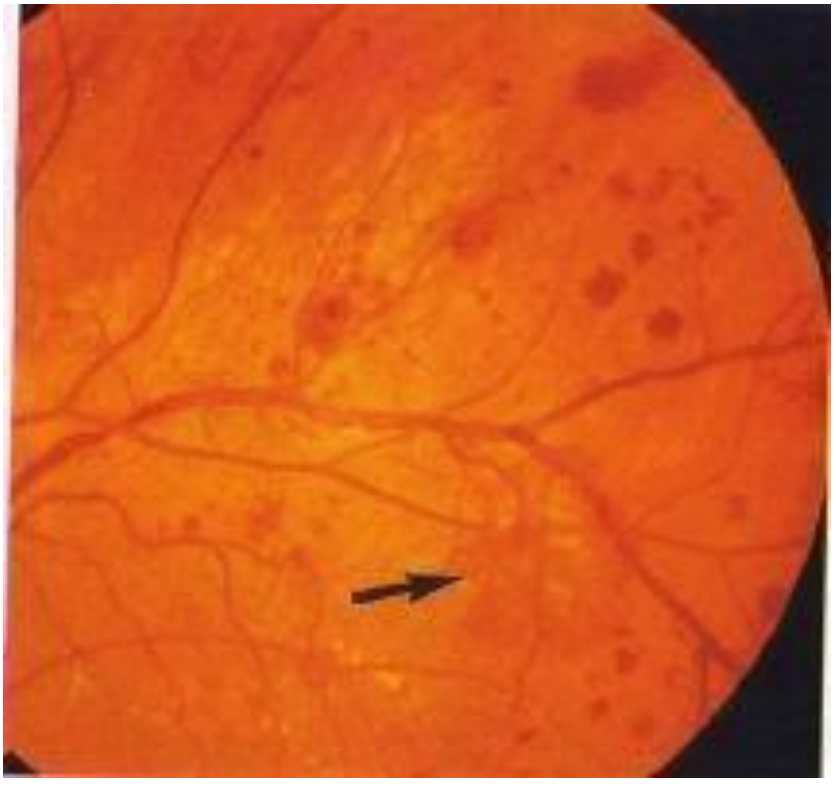
NVD>1/3-1/2 disc area or NVD / Viterous / preretinal hemorrhage.

NVE-1/2 disc area and preretinal / vitreous hemorrhage. [4,31.]

NEO VASCULARISATION AT DISC (NVD)



NEO VASCULARISATION ELSEWHERE (NVE)



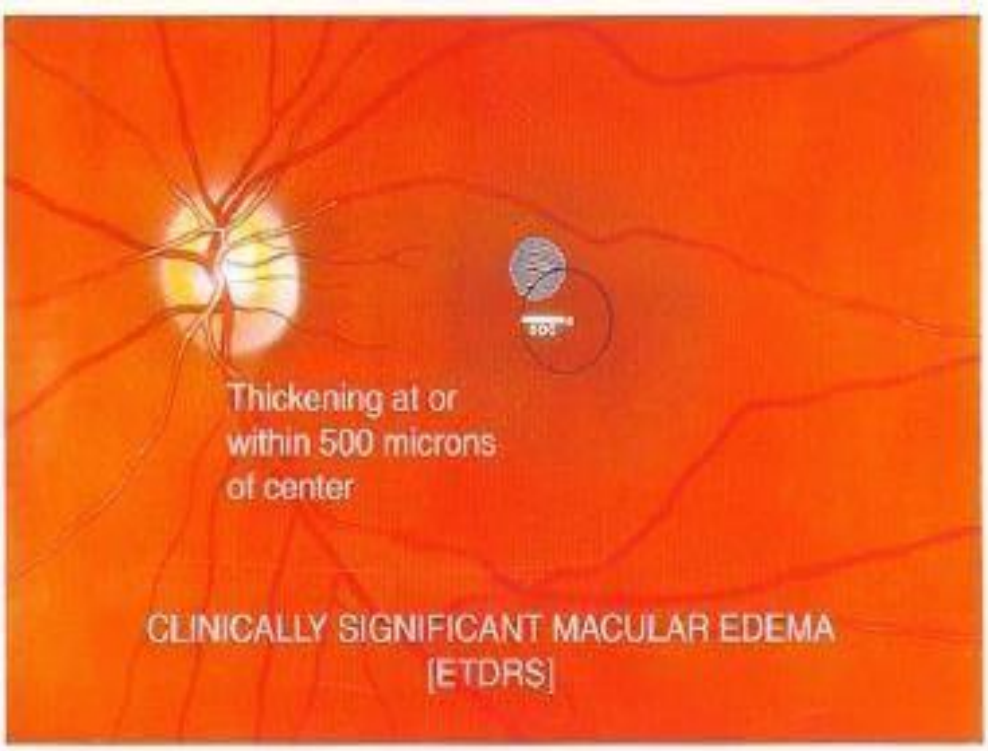
CLINICALLY SIGNIFICANT MACULAR EDEMA :

Clinically significant macular edema (CSME) is detected on clinical examination by ophthamoscopy, as defined in the ETDRS.

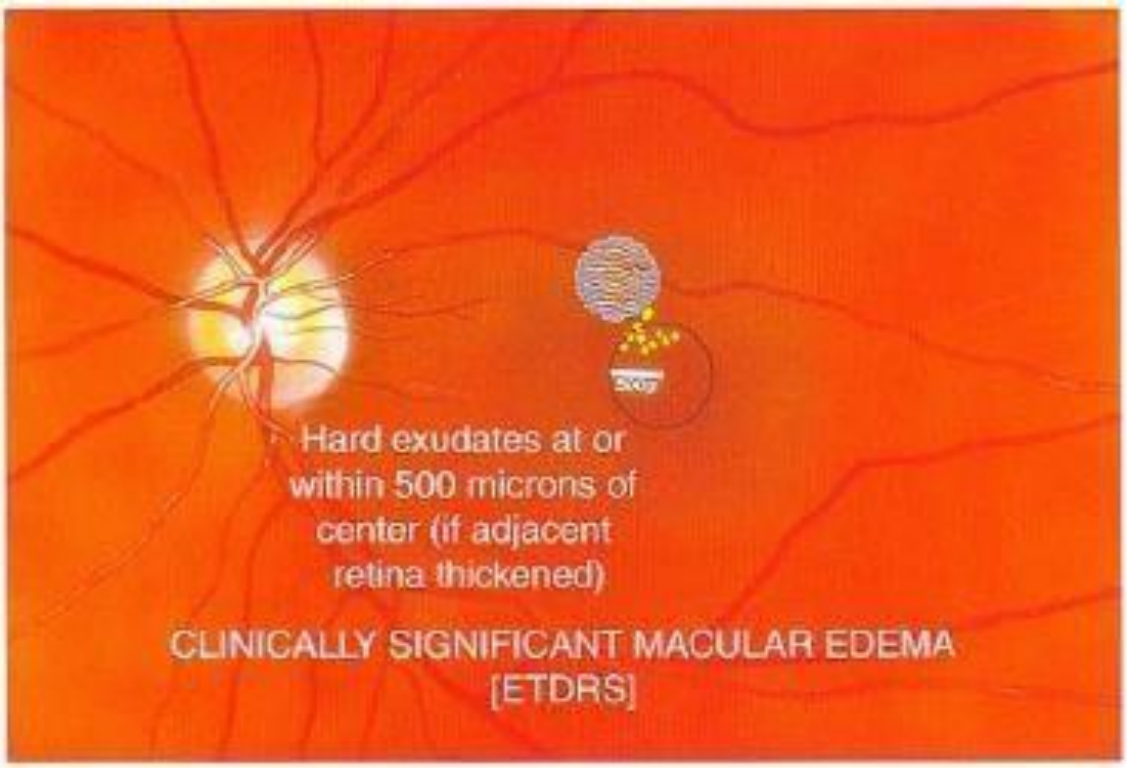
The Early Treatment Diabetic Retinopathy Study (ETDRS) was the first prospective, randomized clinical trial of photocoagulation in diabetic patients with less than high-risk PDR to establish standard treatment paradigms for managing DME.

CSME includes Any one of the following:

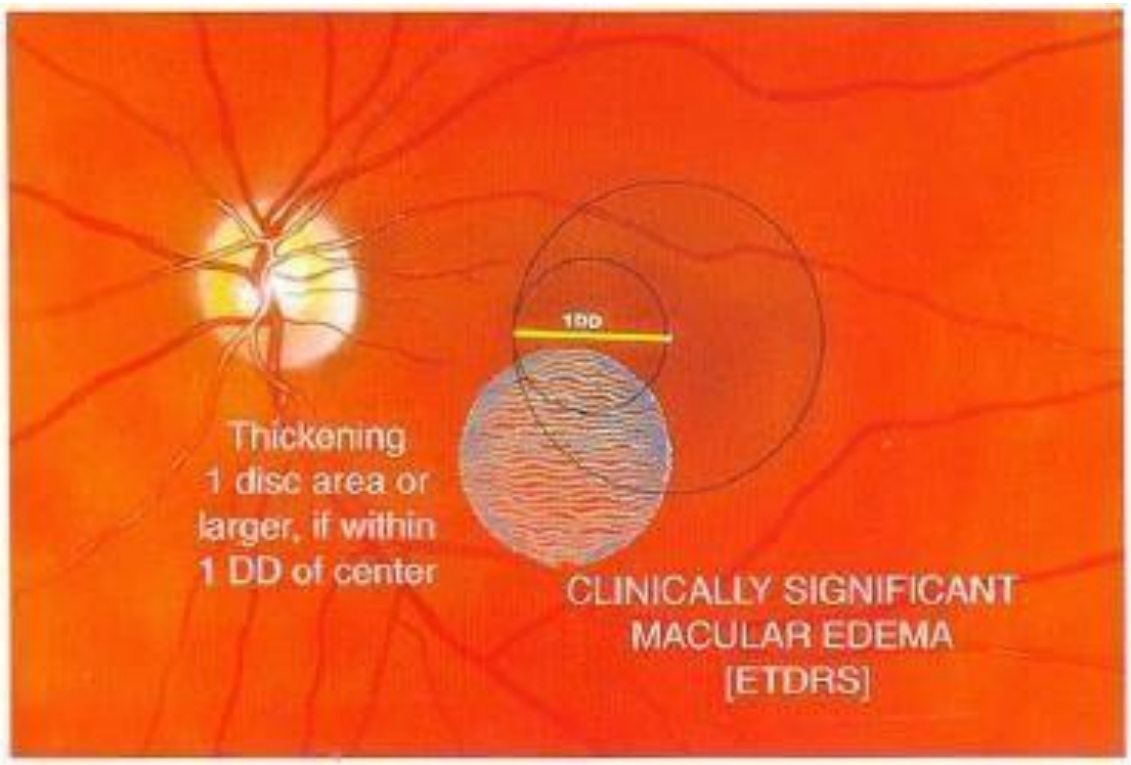
- Retinal thickening within 500 μm of the centre of the macula



- Exudates within 500 μm of the centre of the macula, if associated withretinal thickening; the thickening itself may be outside the 500 μm



- Retinal thickening one disc area (1500 μm) or larger, any part of which is within one disc diameter of the centre of the macula and demonstrates CMO if present.



Studies now use the term *center-involving macular edema* or similar terminology, based on whether or not the fovea appears thickened on OCT scans. Most algorithms for pharmacologic intervention use this simplified, OCT-based definition.

DIABETIC MACULAR EDEMA:

Diabetic Maculopathy: Diabetes can affect macula in several ways, macular edema being the most frequent. It is also the most frequent cause of visual loss in the background stage.

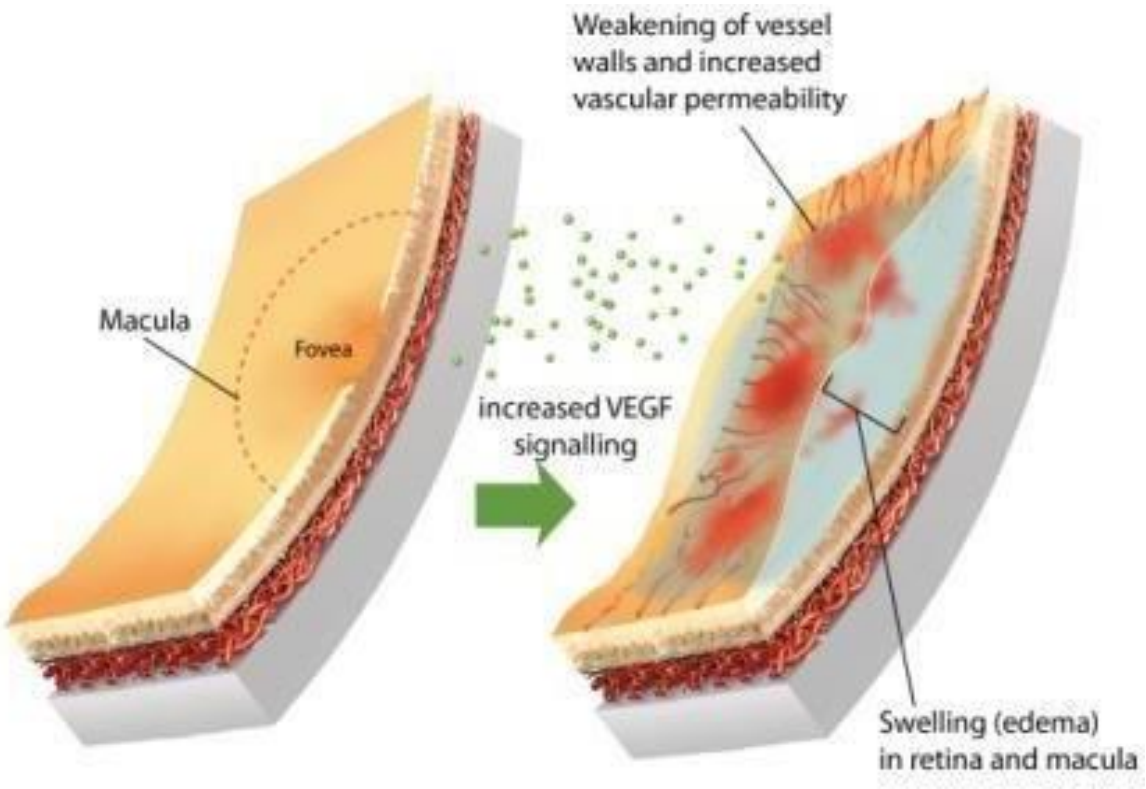
Diabetic Macular Edema is defined as a collection of interstitial fluid within the macula with or without lipid exudates and with or without cystoid changes. Clinically, macular edema is retinal thickening within two disc diameters of the center of the macular (not fluorescein leakage without thickening). Retinal thickening or hard exudates with adjacent retinal thickening that threatens or involves the center of the macular is considered to be clinically significant macular edema (CSME)

Macular edema may be Focal, Diffuse, Ischemic or a mixed variety.

It results mainly from breakdown of the inner blood retinal barrier. It may be present during any stage of retinopathy, though, the percentage of patients with macular oedema increases with increasing severity of retinopathy. Other factors influencing the development of macular edema are the age at onset of diabetes, type and the duration of diabetes. According to the Wisconsin Epidemiologic Study of Diabetic Retinopathy, “the prevalence rate of macular edema is 10% in the diabetic in the older onset patients and even in this group it is seen earlier

after the discovery of diabetes in the older onset patients and even in this group it is higher in those that are being treated with insulin (5% may already have macular edema at the time of diagnosis)"

Diabetic maculopathy (foveal edema, exudates or ischaemia) is the most common cause of visual impairment in diabetic patients, particularly in type 2 diabetics.. The fluid is initially located between the outer plexiform and inner nuclear layers; later it can eventually involve the inner plexiform and nerve fibre layers, until eventually the entire thickness of the retina becomes oedematous. The central accumulation of fluid the fovea forms a cystoid pattern named the cystoid macular edema (CME) that is readily detectable on optical coherence tomography (OCT) and assumes a central flower petal pattern on Fundus Fluorescein Angiography (FFA)

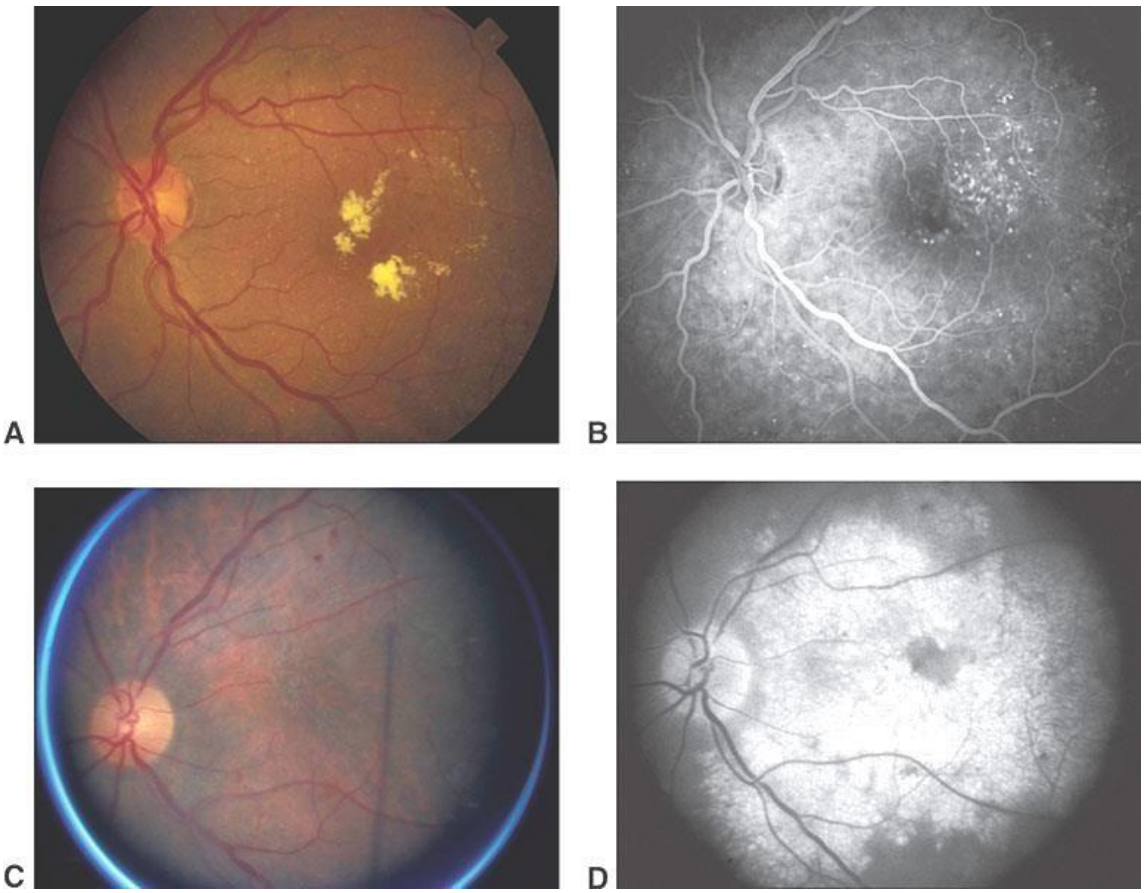


Types of Diabtic Macular Edema:

- **Focal maculopathy**: A well-circumscribed retinal thickening along with complete or incomplete rings of exudates FFA shows late, focal hyperfluorescence due to leakage from a microaneurysm and dilated capillary segments, usually with good macular perfusion.This is a localized leak from a microaneurysm giving rise to a hard exudate, deposited at the junction of normal and abnormal retina. Laser photocoagulation is often very successful in preventing or retarding visual loss and may even result in the visual improvement. However if the exudates are too far advanced, their resorption does occur following the laser treatment but retinal function may already have been destroyed due to which visual improvement may become impossible. Macular plaque is a long standing continued damage due to leakage into the macula.

- **Diffuse maculopathy**: There is diffuse retinal thickening, along with associated with cystoid changes; caused due to extensive capillary leak; there are typically scattered microaneurysms and small intraretinal haemorrhages . Landmarks may be obscured by edema, which may render localization of the fovea impossible. FFA shows mid- and late-phase diffuse hyperfluorescence, It is characterized by a wide spread leakage of fluid from retinal capillaries, IRMAs &microaneurysms, leading to a diffuse macular oedema and a reduction in vision. Clinically, there is retinal thickening, loss of macular reflex and at a later stage development of cystoid macular edema due to a breakdown of the intervening normal retinal tissue. It may also present as scattered exudates in a non – circinate pattern. Without laser treatment in such cases, there is a continued fluid accumulation and destruction of the foveal architecture. Laser photocoagulation aims at limiting this destruction of macular structure and function.

Focal macular edema may be associated with hard exudates, which are precipitates of plasma lipoproteins. Because resorption of extravascular aqueous occurs at a faster rate than that of plasma lipids, lipid residues often remain behind after the fluid has resorbed. These yellow-to-white lipid deposits accumulate within the outer and inner plexiform layers or beneath the sensory retina.



Focal and diffuse macular edema

A. Color fundus photograph showing circinate hard exudates surrounding a group of microaneurysms in an example of focal macular edema.

B. Fluorescein angiogram confirming the microaneurysms, which appear as a group of punctate foci of hyperfluorescence in FFA.

C. Color fundus photograph shows diffuse macular edema demonstrating diffuse thickening of the retina with glistening surface.

D Fundus Fluorescein angiogram confirming the diffuse intraretinal leakage.

Diffuse macular edema is characterized by extensive retinal capillary leakage and widespread breakdown of the blood–retina barrier, often accumulating in a cystoid configuration in the perifoveal macula (cystoid macular edema)

Whether the pattern of macular edema is focal or diffuse, treatment decisions are based upon lesions meeting defined size and location criteria that determine clinical significance.

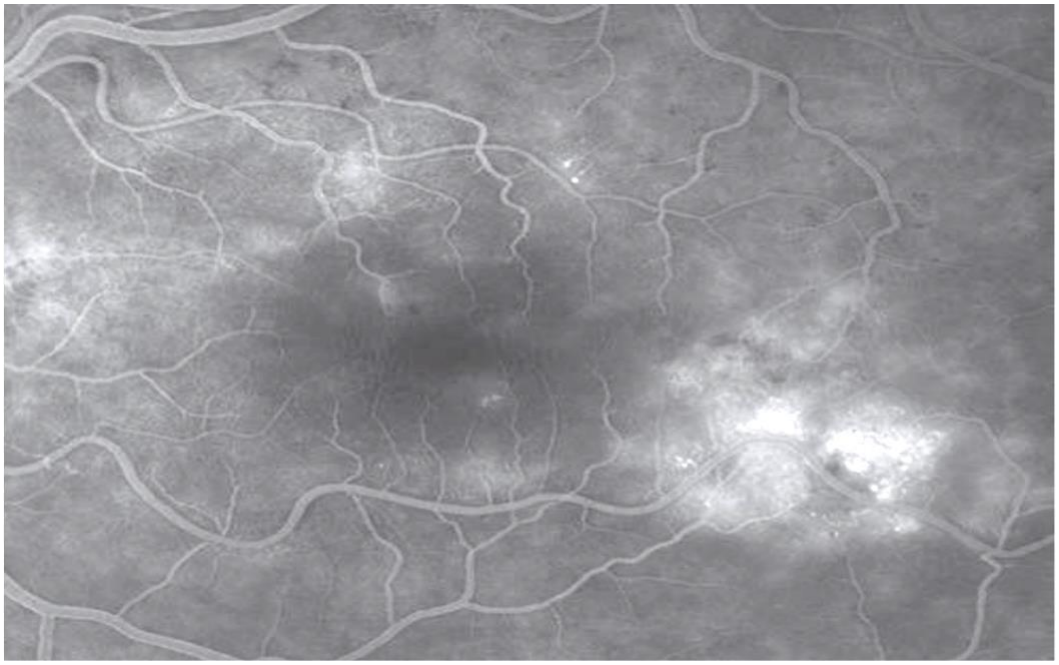
Ischaemic maculopathy:

This type of maculopathy occurs as a result of non-perfusion of the parafoveal capillaries with or without intraretinal fluid accumulation. It usually coexists with the other types, but in its pure form is the least easy to recognize and diagnose. Ophthalmoscopically one may find a dull appearance to the macula. However an FFA is necessary to confirm the diagnosis. It is essentially untreatable. Improvement of a poor diabetic control may retard the progression, but too rapid an implementation can also lead to a transient worsening of retinal ischemia. Prepoliferative and proliferative changes should be actively looked for in such cases and treated early because it will help reduce the risk of further visual loss from extra – macular complications. Microaneurysms may cluster at the margins of zones of capillary nonperfusion of retinal arterioles and can result in larger areas of nonperfusion and progressive ischemia. Evidence of enlargement of the foveal avascular zone greater than 1000microns in diameter generally leads to visual loss.

Signs are variable and the macula may look relatively normal in Ophtalmoscopy, despite reduced visual acuity. In other cases PDR may be present.

FFA shows capillary non-perfusion (CNP) at the fovea (an enlarged FAZ) along with other areas of capillary non-perfusion at the posterior pole and the periphery.

ISCHEMIC MACULOPATHY:



* **Mixed:** Diabetic maculopathies rarely exist isolated and most commonly have two or more of the components listed above. Management is the treatment of remediable elements after assessing their respective contributions by FFA.

Other mechanisms in which macula is affected in diabetes are as follows:

* Traction on the macula by a fibrous tissue proliferation causing a drag of the retinal tissue, surface wrinkling or detachment of themacula.

* Intraretinal or preretinal (subhyaloid) haemorrhage on the macula.
* Lamellar or full – thickness macular hole formation.
* Any combination of the preceding.

IMPORTANCE OF VISUAL ACUITY:

In ophthalmoogy, the first & foremost step is assessment of visual function with simple equipments of the test which is easily administered. Visual acuity is defined as the "spacial resolving capacity" of the eye. According to Parson, the definition of visual acuity is estimation of eyes ability to discrimination between two points. If visual acuity is tested multiple times on a particular chart, the expected difference should be Zero.

Test_retest variability (TRV) is distribution of scoreswhich reflects the underlying variability in the chart measurement in the absence of any clinical change (in reality). TRV increases with the ability to defect true change in vision decreases [7].

If a person have 3.5 line change in vision, it may not be represented as true change. In this study comparison of visual acuity is done using Snellen's's and logMAR chart in diabetic people with and without maculopathy. Peter [7] in his study describes 13% patients having 2 line discrepancy in vision on repeated testing in Snellen's chart. By using specialized eye charts visual acuity is tested in practice. It consists of upper case letters arranged in rows with largest letters in top and small letters down the chart. [6,7]

By testing visual acuity we can monitor the function of the visual system. It is one of the most sensitive ways. Therefore it is important to ensure that the chart used to measure VA is accurate and repeatable.

The Snellen's's chart first developed in 1862, commonly used for testing VA in clinical practice, though it lacking an accurate scoring system. [9]

The logMAR Bailey-lovie chart provide more standardization and accuracy in the screening process, it was developed using a family of 10 non-serif letters [10]. The early treatment diabetic retinopathy study used the same logMAR chart with a family of 10 sloan letters to develop the logMAR". chart which is considered the gold-standard chart for VA testing. This helps to qualify visual potential and to differentiate normal form abnormal. Clinically visual acuity is measured by asking the subject to discriminate letters of knowing visual angle.

logMAR chart use letters of equal recognition. These charts use the log of minimal angle resolution 10.

logMAR chart requires more time compared to Snellen's chart though it is considered as gold standard over Snellen's chart in clinical practice.

Snellen's chart is easy to use for visual function assessment than logMAR chart in developing counrty like India. [9]

This study is to import the comparison and evaluation of VA assessment using Snellen's & logMAR chart, using various parameters like VA scores, gender, age, duration of diabetes, and variables like time factor,letter score and distance at 4metres

Review of Literature

REVIEW OF LITERATURES

VISUAL FUNCTION:

The ability to recognize an object of interest,through visual space, handle visual scenes and help in recognition of the world differently is known as intactness of visual function. [12,13,14,15,16]

Assessment of visual acuity comprises of stereo acuity, reading fluency and reading comprehension [16]. visual acuity assessment is the most common used tool to measure visual function [12,14,15,16.]

VISUAL ACUITY:

It is important tool for the following. [20]

1. To verify the optical correction of refractive errors.

2. It act as a screening device to find out ocular abnormalities

3. To monitor the effects of diseases, its course and treatment

4. To determine the visual aids for individuals of normal and subnormal vision

   To estimate a person's ability to perform certain tasks (like driving licence, assessments of colour vision).

VISUAL ACUITY TESTING:

The smallest angle of separation between two points which allows the formation of two discrimable images by the optical system is known as resolving power. [13]

For distinguish two separate points, it is imperative that their images formed on cones are not adjacent to each other but separated by an unstimulated cone. In order this to happen, the object of fixation must subtend a visual angle of 1 minute of an arc at nodal point of eye. This is the minimum resolving angle of the eye [16.] The ability of the eye to discreminate two objects that are separated in space is known as spatial resolution.

In 2009 vessely petel [43] , proved that the difference between the threshold interpolation method mod on logMAR chart and the whole-line mode on Snellen'ss chart ($p<0.001$). on Snellen's chart the values measured were overvalued. The exact and reliable measuring of visual acuity is important to make a correct diagnosis of pathological changes on human eye structures

In a study conducted by Lim et al[44], 2010 concluded that theoretical advantagesof ETDRS design still measurable, TRV was small. In this study, the average vision with respect to duration of diabetes with < 1 year were 8 patients(6/9 – 6/6) with Snellen logMAR Equivalent 0.2 – 0.0 and the corresponding ETDRS were 20/30 – 20/20with logMAR (0.63 – 1.0).

MAINTENANCE OF Snellen's, logMAR VISUAL ACUITY CHARTs AND ROOM:

The amount of illumination on the the test chart which has considerable influence on visual acuity is recorded. A standard of l00 ft CS is used for illumination of test chart[20] Peter k.k. etal [7], proved if VA worsened, there was increased variability between charts and the mean discrepancy between charts increased. Patients with exudative (ARMD) age related macular degeneration had greatest disparity on vision testing, patients with dry ARMD with diabetic retionpathy also exhibited significant differences.

THE IMPACT OF VISUAL ACUITY IN DIABETIC POPULATION WITH REFERENCES TO DIABETIC RETINOPATHY:

Falkenstein IA et al [45], showed poor agreement between Snellen's and logMAR chart, and it was more pronounced in the group with poor vision. The logMAR measurements yielded better VA, in participants with vision <20/200 (represents more advanced AMD patients). taking these findings into consideration while comparing outcomes in clinical practices (which typically measure VA using Snellen's's charts) with outcomes from clinical trials (which typically measure VA from logMAR cha;rts) in 2008.

In a study conducted by Li Ming Dong et al[48], in the year 2002 for consistency between visual acuity scores obtained at different test distances. (theory vs observations in 4 multiple studies) the VA scores at distance > 2 mts were lower than

expected in all 4 studies. After adjustment for test distance, VA scores obtained at closer distance were found to be systematically lower than those obtained at farther distance in all datasets. In the submacular surgery trials pilot study, the average discrepancy between 2 and 0.5 mts VA scores were 7.5 letters. Similar results were obtained in macular photocoagulation study, (3.1 letters with test distance 10 feet and 5 feet), laser to drusen trialstudy (7.3 letters with test distance 3, 2 and 1 mts), treatment of ARMD with (PDT)Photodynamic therapy(8.2 letters with test distance 2 and 1 mts).

Reduction in visual angle at closer test distance did not explain the discrepancy completely. Features of macular vision, poor accommodation of elderly people with ARMD or the test charts did not account for the discrepancy.

P.K. Kaiser[7] in 2008, showed than mean Snellen's vission was 20/86 & ETDRS was 20/72 ($p<0.05$).subgroup analysis showed that the difference between Snellen's and ETDRS vision was greatest with patients with poor vision(<20/200). on average, Snellen's acuities were slightly worse than equivalent “ETDRS” acuities especially with vision <20/200. However Except for patients with poor vision Snellen'ss and “ETDRS” charts were comparable.

The mean difference was 6.5 letters better on the ETDRS chart with ($p<0.005$) in patient with exudative age related macular degeneration.in dry AMD and diabetic retinopathy showed significant differences .He concluded visual acuity scores were He concludes that visual acuity scores were better on logMAR charts compared to

Snellen's. The difference was great with poor visual acuity (<20/200) in and in patients with exudative ARMD.

P.k. kaiser [7] in 2008, showed mean Snellen's vision was 20/86 and logMAR 20/72 ($p<0.05$). sub group analysis showed difference between Snellen's and logMAR vision greatest in patients with poor vision (<20/200) on average, Snellen's and acuities slightly worse than equivalent "logMAR" acuities especially with vision <20/200. However except for patients with poor vision, Snellen'ss and logMAR chart were comparable.

Bailey[10] in the year 1976, introduced new principles fot the use of letter charts for the measurement of visual acuity. Test task should be essentially same at each size level on the chart. Such standardization requires the use of letters of equal legibility, same number of letters on each row, uniform between letter and row spacing. It is also states that, there be a logarithmic progression of letter size.

VISUAL OUTCOME IN DIABETIC MACULOPATHY:

In Falkenstein[45] and colleagues study, termination of test made when patient made >2 errors for lines with more or equal to 5 letters, more than 1 error for the lines with 3 or 4 letters, or any error for a line with less than 2 or equal letters on the Snellen chart or more than 2 letters on a line with ETDRS Chart. This is different from the ETDRS protocol and have led to an artificially larger difference between the charts.

Legal blindness (best corrected visual acuity of 6/60 or worse in the best eye) is found to be twenty-five times more common in the diabetic population than in those without the disease.

Therefore, early and regular screening of all diabetic patients is required to prevent blindness in an already disabling disease

So this study will help in the planning for a screening program for diabetic maculopathy and the prevention of blindness due to diabetics.

VISUAL ACUITY & DIABETES

In this study, only gross visual acuity is being accounted for comparison, though BCVA is identified individually. In diabetics the increase in duration of diabetes played a pivotal role in worsening of visual acuities.

In this study, the ETDRS staged mild non-proliferative diabetic retinopathy (mild NPDR) in 77 patients, moderate NPDR in 19 patients, severe NPDR in 2 patients, very severe NPDR in 1 patient and early proliferative diabetic retinopathy in 1 patient.

Panretinal photocoagulation (PRP) was advised for the early PDR patient and this patient underwent PRP in 3 sittings in 3 consecutive weeks, VA improved 1-2 lines after 3 weeks of PRP.[35,39] In this study of severity of diabetic retinopathy the baseline of study proved majority were in mild NPDR followed by moderate NPDR.Robert C.Ramsay et al[66] in their study confirmed the stabilization of baseline visual acuity in a majority and deterioration in some. Patients in this study by Robert C.Ramsamy were both Type I and Type 11 DM, followed for aminimum of 2 years. As this study had a short follow up, the end result could not be compared though similar causes of visual loss were found to beproliferative retinopathy and macular edema. Moreover where type 1 DM is associated with greater incidence of proliferative retinopathy on long termthe same does not hold good for Type 11DM who formed the major in this studygroup.

Berman et al[67] noted 7 eyes in background retinopathy and 8 eyes of non proliferative retinopathy to have macular edema. Both these groups constituted a majority of the total retinopathy. Prompt treatment in the form of focal, panretinal photocoagulation or both resulted in stabilization of vision, Whereas in this study macular pathology was notincluded.

Kline[36] et al has suggested that type II DM is a group prone to macular edema. Baseline visual acuity was noted to be stabilized in a majority but thiswas just a one year follow up which needs to be further followed up for longtime.

As in the BVOS study[50], it is reasonable to consider laser photocoagulation for macular oedema due to branch vein occlusion as the ETDRS protocol cut off was 20/50.

For clinical trials with patients with good vision, it is reasonable to assume that the ETDRS vision will be that of 1-5 letters of same line of Snellen‟s vision. As all the clinical trials does not record the gross visual acuity, as in many cases it is the best corrected visual acuity (BCVA)

In eyes with poor visual acuity (< / equal to 20/200), there exists 2 to 5.6 letters of that of snellen‟s chart. falkenstein noted a discrepancy of 4 lines, & Dr.Gary Abraham has suggested 3-4 lines in exudative AMD patients.

Aim & Objectives

AIMS AND OBJECTIVES

AIM

To assess the use of logMAR chart and comparing it with snellens chart in a patients with diabetic maculopathy

OBJECTIVES

To compare and quantify the difference in VA measurements between the two of the most widely used charts for VA assessment.

This study gives information about rapidly emerging clinical trial and clinical case series data on treatment options for diabetic maculopathy as well as for other retinal diseases

Materials and Methods

MATERIALS AND METHODS

STUDY DESIGN:

This was a cross- sectional study.

STUDY SETTING:

The study will be carried out at department of ophthalmology in Government Stanley Medical College Hospital.

STUDY POPULATION:

Sample size included to patients [140 eyes] calculated using following formula.

SAMPLE SIZE CALCULATION:

- Based on the reference study.
- Formula

  $N=2\ (Z_a+Z_b)^2\ SD^2\ (M_1-m_2)$

- Where Z_a= (Statistical significant constant for 95% CI).
- Z_b=0.84 (30% power).
- SD= 0.50 (standard deviation of visual acuity using logMAR chart among diabetes with maculopathy.
- M_1=0.79 (Mean visual acuity using logMAR chart among diabeties with maculopathy).
- M_2=0.54 (Mean visual acuity using Snellen'ss chart among diabetics with maculopathy).

- $(M^1-M^2)=0.0625$ (0.25x0.25).
- On substituting on formula

  n=15.6x0.50x0.50/0.0625

  n=62.
- Adding 10% non response rate

n=68 (minimum sample size)

Therefore sample size n=70 (1 group) & n=140 eyes (2 group).

INCLUSION CRITERIA:

1. All diabetic patients with and without maculopathy age between 30 to 60 years.
2. Subjects with refractive errors <4.00 dioptres, Astigmatism <2.00 dioptres.
3. Diabetic population of random blood sugar (RBS) cause less than 200 mg ldl were included.

EXCLUSION CRITERIA:

1. Subject with high refractive error >4.00 D dioptres Asigmatism >20.. D dioptres.
2. Patient with media opacities.
3. Patients with macular disorders
4. Patients with chronic complications other than diabetic retinopathy.
5. Diabetics with RBS >200 mg /dl.
6. Presence of acute eye conditions like conjuctivitis / uvcitis / comeal ulcer.

SAMPLING:

All diabetic patients attending ophthalmology out patients department undergo comprehensive eye examination with preliminary gross visual acuity and fundus examination. They were explained regarding the study and those who are willing were included in this study. The patients were recruited will assign in to diabetic with and without maculopathy. The information consent will be explained and clearly mentioned in the format. Evaluation procedures were carried and 140 eyes were examined. If patients were not willing to continue the complete test, the patient will be relieved at any stage of study.

INSTITUTIONAL ETHICAL COMMITTEE APPROVAL:

The study protocol was approved by institutional ethical committee includes members from outside the institution as per the ICMR guidelines required for any study conducted in the institution.

STUDY INSTRUMENTS:

1. For distance vision - Snellen's and logMAR chart.

2. Slit lamp - Appasamy model IAI II3s/3s2.

3. Fundus examination by +90 d Volks lens.

STUDY TOOLS:

Snellen's"s CHART:

This was first introduced by Dutch ophthalmologist, doctor Hermann Snellen's in 1862,is the current standard for measurement of visual acuity in clinical practice [7]. The chart has letters of different size arranged from largest at the top to the smallest at the bottom, which are read one eye at a time at a distance of 6metre(20 ft) [6,7,9]. Each letter on the chart subtends an angle of 5 minute of arc at the appropriate testing distance and each letter part subtends an angle of 1 minute of arc .It is designed to measure acuity in angular terms. In healthy adults, the resolution limit is between 30s and one minute of arc. The scoring method used is the line assignment[9] method where the patient gets credit for lines, not letters, read. Accepted convention does not specify Snellen's acuity in angular terms,instead Snellen's acuity is expressed as a fraction with the numerator equal to the distance from the chart and the denominator being the size of the smallest line that can be read.[8,9] The reciprocal of the fraction equals the angle, in minute of the arc, that the stroke of letter subtends on the patient side known as minimal angle of resolution.[6]

The advantages are easy to perform,quick in assessing,useful in visual acuity testing in illiterates.

The disadvantages are each line has a variable letter size,variable letters per line**,** lack of standardized progressions between lines.Parametric analysis cannot be performed with decimal progression even if converted to another form.There is an irregular and arbitrary progression of letter sizes between Good acuity lines have greater crowding phenomenon

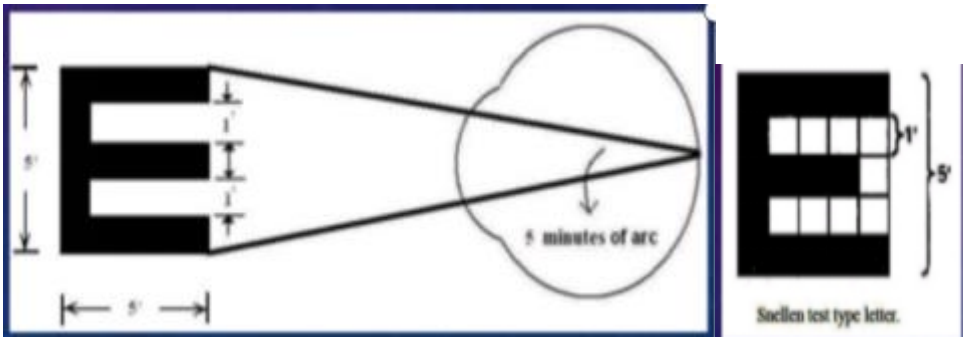
VA=DISTANCE OF THE PATIENT FROM THE CHART

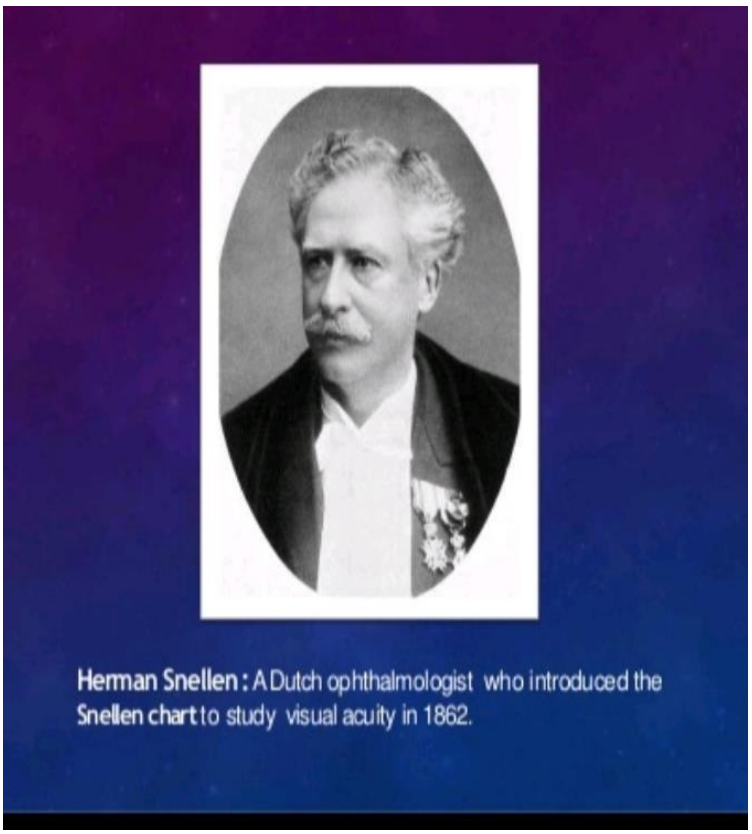
SMALLEST LINE READ BY THE PATIENT

PRINCIPLES OF Snellen's'S ACUITY:

Each letter is designed in a square with sides 5 times the width of letter strokes.

- The breath of black strokes and white spaces are equal.
- The breath of line and spaces produce 1'min of arc at nodel point when viewed from a certain distance.
- Each letter substance an angle of 5' of arc at nodel point at seen at a certain distance.





THE ADVANTAGES:

Easy to perform.

Quick in assessing.

Useful in VA testing in illiterates.

DISADVANTAGES:

Each line has a variable letter size.

Variable letters per line.

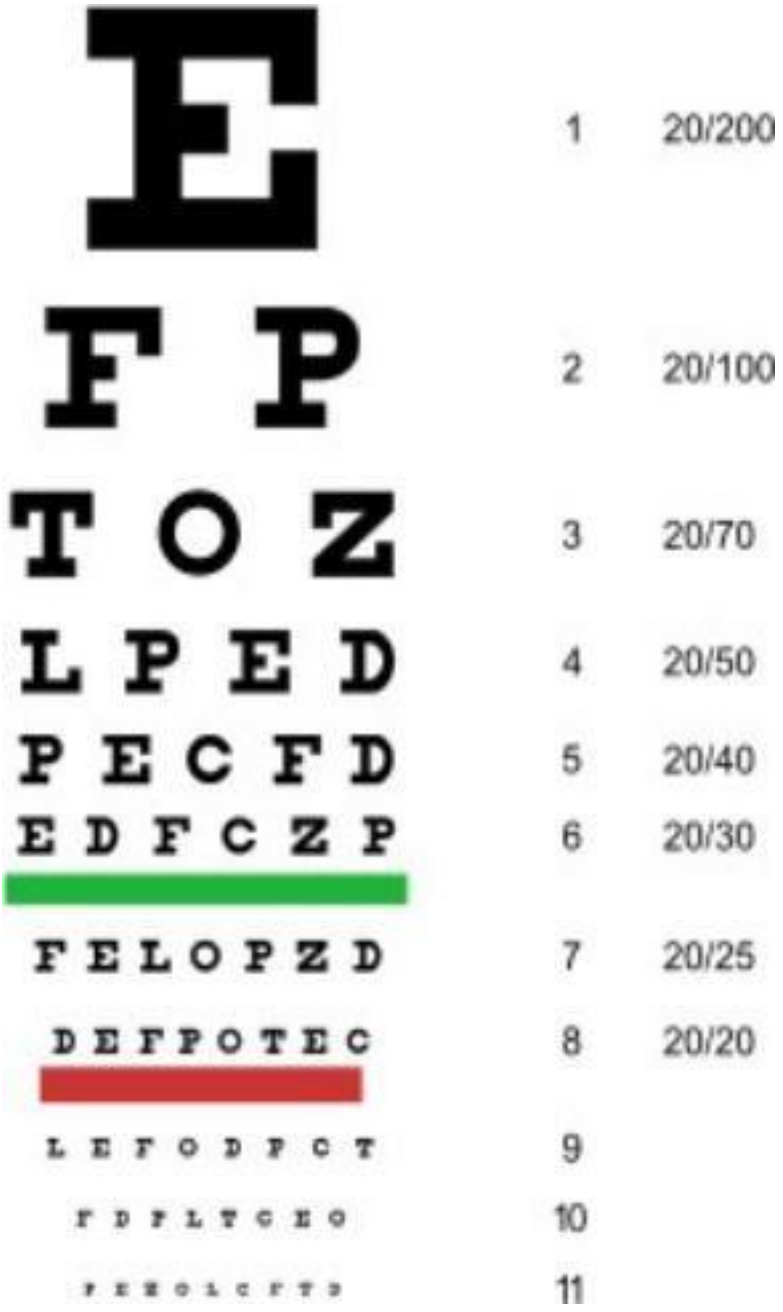
Lack of standardized progressions between lines.

Parametric analysis cannot be performed with decimal progression even if converted to another form.

Irregular and arbitrary progression of letter sizes between lines.

Greater crowding phenomenon.

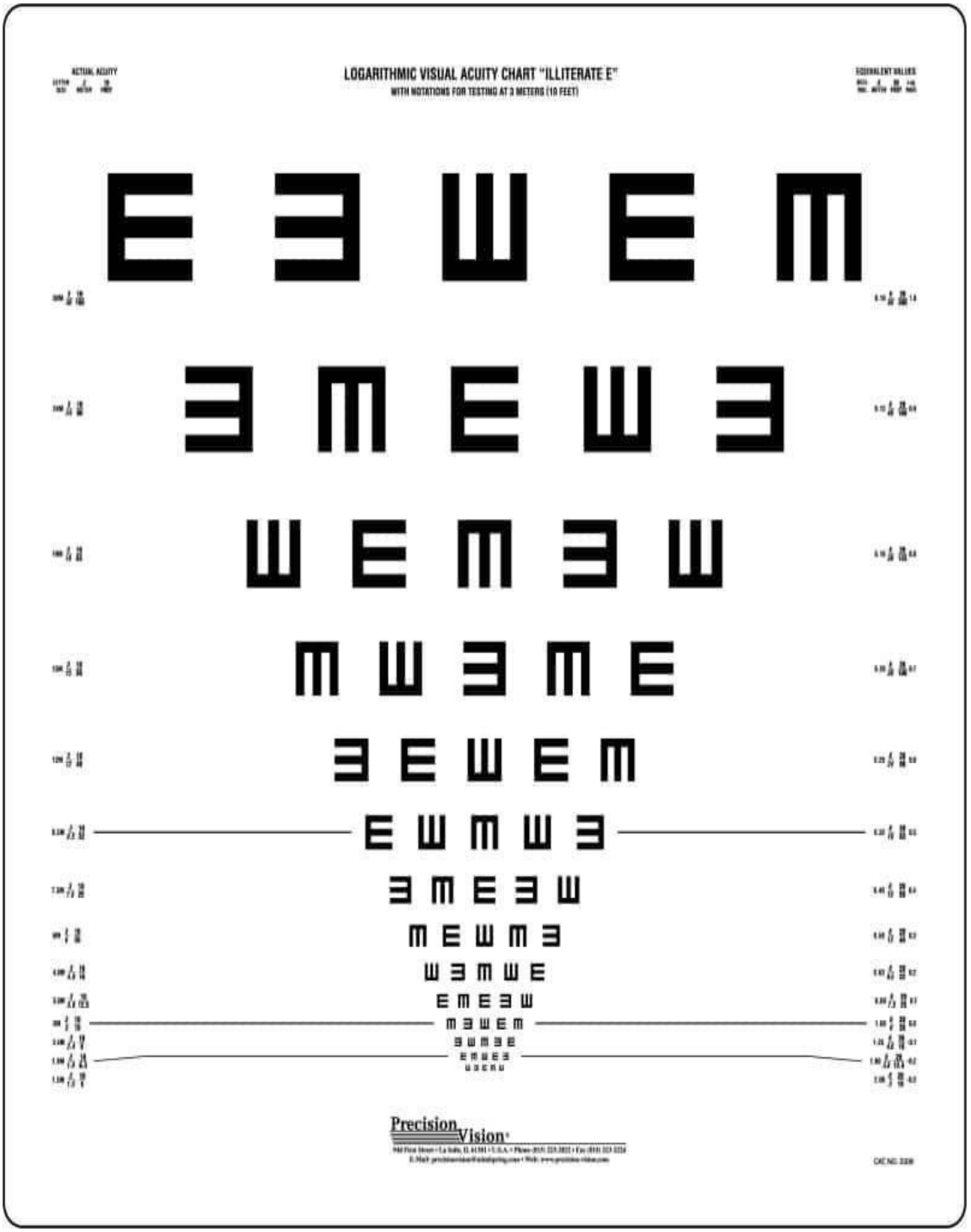
SNELLEN'S CHART



Snellen's'S EQUIVALENT

logMAR	Snellen's EQUIVALENT
1.0	6/60
0.9	6/48
0.8	6/38
0.7	6/30
0.6	6/24
0.5	6/19
0.4	6/15
0.3	6/12
0.2	6/9.5
0.1	6/7.5
0.0	6/6
-0.1	6/5

logMAR Chart



logMAR Chart

TABLE 1. CONVERSION OF SNELLEN ACUITY INTO LOGMAR, DECIMAL, AND METRIC UNITS

logMAR	SNELLEN	DECIMAL	SNELLEN (METRIC)
1.5	20/640	0.03	6/192
1.4	20/500	0.04	6/152
1.3	20/400	0.05	6/120
1.2	20/320	0.063	6/96
1.1	20/250	0.08	6/76
1.0	20/200	0.10	6/60
0.9	20/160	0.125	6/48
0.8	20/125	0.16	6/38
0.7	20/100	0.20	6/30
0.6	20/80	0.25	6/24
0.5	20/63	0.32	6/20
0.4	20/50	0.40	6/15
0.3	20/40	0.50	6/12
0.2	20/32	0.63	6/10
0.1	20/25	0.80	6/7.5
0.0	20/20	1.00	6/6
-0.1	20/16	1.25	6/5
-0.2	20/12.5	1.60	6/3.75
-0.3	20/10	2.00	6/3

logMAR CHART

To overcome the deficiency of Snellen's chart, bailey-lovie chart was modifiedin the year 1982 based on the recommendations of the committee on vision of the national academy of sciences, national research council and working group[39] and by Dr. Rick ferris for use in the early treatment diabetic retinopathy study[7]. This LOGMAR chart and the protocol to test vision with this chart

have become gold standard for most current clinical trials. LOGMAR charts have interpatient differences more accurately measured longitudinal follow up measurements, more consistent precisions, regardless of whether the patient had high or low levels of visual acuity.Bailey – lovie charts have the same chart design but vary in the letters used in the consrtruction.[11] All letters used in this chart have equal legibility. The letters in the LOGMAR chart have height equal to 5 stroke width and have non – serif letters. Each row has sloan letter and there are 14 rows of letter (70 letters)The sloan letters were proposed by Dr.sloan in 1952 and are composed of 10 non- serif, upper case letters formed within a square outline, with a stroke width 1/5th the letter height(C,D,H,K,N,O,R,S,V,Z) and with equal legibility[11]. Consistent spacing between letters and rows, proportional to letter size.The between- letter spacingwas 1 letter -width and between- row spacing was equal to the height of letters in smaller row[14].

This controlled the crowding phenomenon seen with theSnellen's chart. There was equal point 0.1 logarithmic intervals(a ratio of 1.26*)in the progression of letter sizes between the lines[14]. A geometric progression of the chart was difficult based on the distance from the patient. despite the fact logMAR charts have proved to be accurate. Most of the recently published studies in ophthalmology have used Snellen's chart for vision testing[11].The main reason for this clinical testing with logMAR charts is felt to take longer time, require specialised lanes and more difficult to administer than testing with Snellen's Chart. This conflict of thoughts between usage of Snellen's and logMAR motivated this study to really check the visual outcomes of both charts.[17]

Procedure of testing.

The visual acuity was assessed by a single examiner under standardized room with illumination of 160 watts. Lux meter was used to evaluate the lighting condition. The patient‟s gross visual acuity was assessed with

Snellen's chart at 6 m and 4 m. After an interval of five minutes, vision was again assessed, with logMAR charts at 4m andlogMAR value noted. Finally, Snellen's value was converted to logMAR.

For the gross visual acuity, the Snellen's chart was presented to the patient at 6 m & 4 m. The patient is comfortably seated and occluderplaced in thetrial frame, at 6 meters and 4 metersdistance, size of letters the patientable to read with testing eyes were noted.For example the vision testing started with the top of the chart and continued until a line was reached where more than half the letters (ex, 2 of 4, 3 of 5) were read correctly or the patient read all letters on the chart.

Only the Snellen's chart projections were used, and the additional features of tumbling E charts were used for illiterate patients.

The luminance of the projected chart was measured by a digital light meter, the patients were encouraged to read and tell the letter. If patients could not see the top letter of the chart,(<6/60), they were progressively moved forward 1-meter intervals until the patient could correctly identify the direction of the letter.

logMAR Chart Testing

For gross visual acuity testing logMAR chart placed at 4 m from the patient in a back stand. The logMAR chart printed with high contrast lettering. The chart had 5 letters per line arranged in 0.1 logMAR steps as specified in the ETDRS protocol. The patient is seated comfortably and asked to read the letters one by one with the testing eye, by placing occluder in trial frame, the vision noted separately for Right and Left eye. The Log MAR value of both eyes will be entered .The time taken to identify the letters for both Snellen's and logMAR charts werenoted with help of stop watch. Letter score for logMAR was then calculated for each eye.

SNELLENS visual acuity at 4meters

LOGMAR visual acuity at 4metres

CALCULATING THE VISUAL ACUITY SCORE:

The examiner records each letter identified correctly by the subject as he/she reads the chart by circling the corresponding letter on the logMAR score sheet (study form). Letters read incorrectly are not marked on this form. Each letter read correctly is scored. The score for each line and the total score for the each eye are recorded on the form, as soon as the 4 meters testing has been completed.[18]

The MAR(minimal angle of resolution) is arrived at by dividing the denominator by distance at which the letter are read.i.e.,Snellen's fraction is inverted and reduced.A Snellen's acuity of 6/12 or 20/40therefore corressponds to a MAR of 2 minutes of arc.

logMAR allows for constant geometric progression over each step. The Progression of difficulty from over line to next is uniform. A Snellen's acuity of 6/12 or 20/40 or MAR of 2 minutes of arc corresponds to a logMAR of 0.3. Ifthe patient reads two alphabets in next line, the logMAR Visual acuity will be recorded as 0.3+(2x0.02 =0.34).Each letter on the chart is equal to 0.02

logMAR. This deviation has been used in construction of logMAR chart.It usesa combination of 10 alphabets with ratio of 5.5. The size of letter in each row decreasing by a factor of log 10^{10} .The distance between each letter is equal to the width of letter.

The same procedure obtaining visual acuity for the right eye is used for the left eye with logMAR visual acuity chart .

After each measurement of visual acuity, the visual acuity score for the visit is calculated.

The proportional layout with equal number of letters on each line has the advantage that relative crowding and contour interaction remain the same for all lines, while only the magnification varies. Along with the chart design principles, the clinical scoring of visual acuity in logMAR units as a method forgiving additional credit for each letter read correctly was also described[14]The logMAR Chart is designed to be read at 4metres& is scored in logMAR units. The range of visual acuity is from 6/60 to 6/6, with the log unit for 6/60 being 1.0 & for 6/6 is being 0.0.

Assessment of visual acuity:

These tests are based on the theory that is described below.

The Snellen's acuities are expressed as a fraction, with numerator equal to the distance from the chart and the denominator being the size of the smallest line that can be read. The reciprocal of the fraction equals the angle ,in minutes of arc, that the stroke of the letter subtends on the patient‟s eye and is called the minimal angle of resolution (MAR). The test chart is normally read from 6 metres(20 feet).Thus a person who identifies the letter on the 18 line from a distance of 6 metres, has a visual acuity of 6/18. Normal visual acuity is 6/6, though young adults sometimes be able to achieve 6/4 visual acuity.[18,50]The disadvantage of the Snellen's chart is that it has variable letter size and there are variable letters per line[24]. There is no standardized progression between lines and this makes statistical analysis difficult. Also,the letters on a Snellen's chart are not always of the same legibility, some letters are easier to

read than others. The distance between the letters and the rows is not standardised and contour interactions vary throughout the Snellen's chart[25,26,27].

The landolt „C‟ or the landolt ring is an interrupted circle whose stroke width and gap width are one fifth of it‟s outer diameter. The two borders of theirbreak are parallel. It can be used as a four position or an eight position test[22].

The illiterate „E‟ also called tumbling E chart is commonly used.It is based on five-by –five grid.The E is presented in different orientations at each acuity level and the patient‟s task is to identify the direction to which the limbs of the E Point.This too can be used as either as a four position or an eight position test.[14]

Many other optotypes are available and many may be numerical or in different regional languages

On the other hand, to overcome the deficiencies of Snellen's,logMAR Charts is considered to be one of the more accurate form of visual acuity assessment.[10]

The patient is subjected to undergo comprehensive eye examination.

OPTHALMOLOGICAL EXAMINATION:

Complete opthalmological evaluation includes,

- ❖ Slit lamp examination of both eyes.
- ❖ Fundus examination with +90 D lens.
- ❖ Fundus photographs
- ❖ Diabetic retinopathy is classified as per logMAR classification.

- The anterior segment examined by slit lamp and the posterior segment visualized by +90 D volk lens after dilation of the eyes.

- Then the patient is assigned to the staging of diabetics based on the logMAR protoco, and patients were sent for visual acuity obtained by Snellen's and logMAR chart were tabulated with corresponding logMAR values for comparison.

- For patients diabetes without maculopathy first Snellen's's visual acuity was assessed then it compared to logMAR visual acuity, if that patient logMAR score is decreasing compared to Snellen's's VA, then that patient have been sent for OCT macula.

FOR OBJECTIVE:

Using pearson correlation the minimum difference of visual acuity score to that of maximum difference of corresponding visual acuity were correlated between Snellen's & logMAR . The non parametric T-test were done and and identified by independent T-test and measurable variable chi-square test were performed.

At the outset, both Snellen's and logMAR for both groups were proved to be objective[2] .

STATISTICAL ANALYSIS

- All statistical analysis were performed using statistical package for social science for microsoft windows (spss, version 17).
- The data were not normally distributed therefore Non-parametric tests were performed.
- The data were expressed as mean SD.
- Descriptive statistics were presented as numbers of percentages.
- Independent sample student T-test/Man Whitney test were used to compare continous variables between two groups.
- A person correlation coefficient analysis / Kendall's tace correlation was used to examined the association of two related variable.
- A two sided p value <0.005 was considered statistically significant.
- A chi-square test was used for comparison between two attributes.

Observation and Results

OBSERVATION AND RESULTS

The observational study was conducted with 35 diabetes with maculopathy and 35 diabetes without maculopathy patients and visual acuity were assessed with Snellen's and logMAR charts; hence totally 140 number of eyes were assessed.

Table 1: Mean comparison of visual acuity using logMAR chart at 4 Meter between groups:

Group		Mean	Std. Deviation	P value
VA logMAR 4m	DM with Maculopathy	0.60	0.12	0.119
	DM without Maculopathy	0.64	0.09	

Graph 1: Mean comparison of visual acuity using logMAR chart at 4 Meter between groups

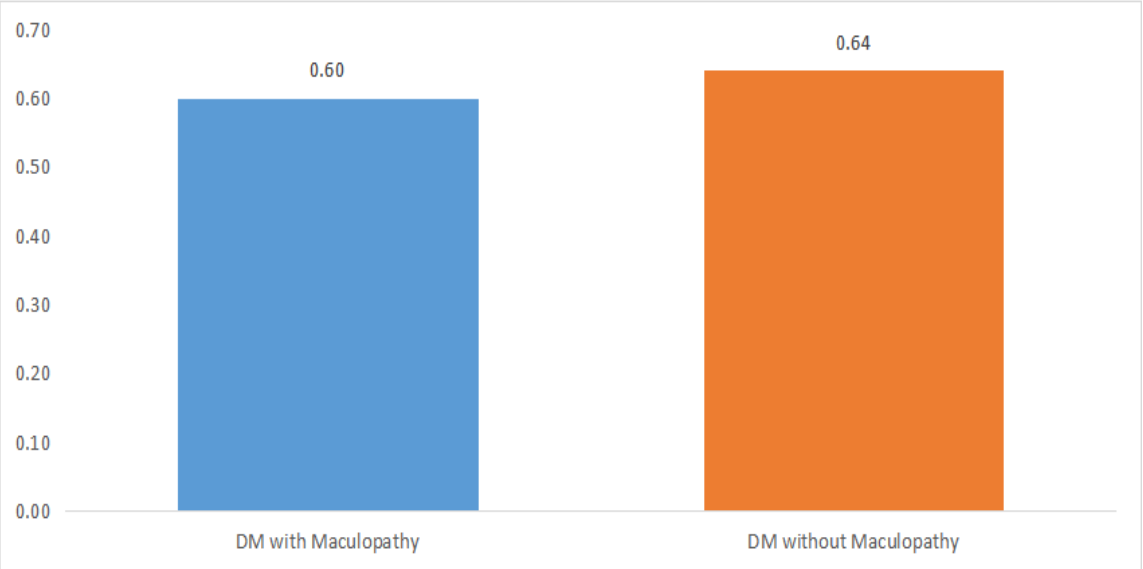


Table 1 describes mean comparison of logMAR chart's visual acuity at 4 meters between groups which is statistically not significant with P=0.119.

Table 2: Mean comparison of Snellen'ss visual acuity at 4 meters between groups

Group		Mean	Std. Deviation	P value
VA Snellen's 4m	DM with Maculopathy	0.41	0.08	<0.0001
	DM without Maculopathy	0.48	0.05	

Graph 2:Mean comparison of Snellen'ss visual acuity at 4 meters between groups

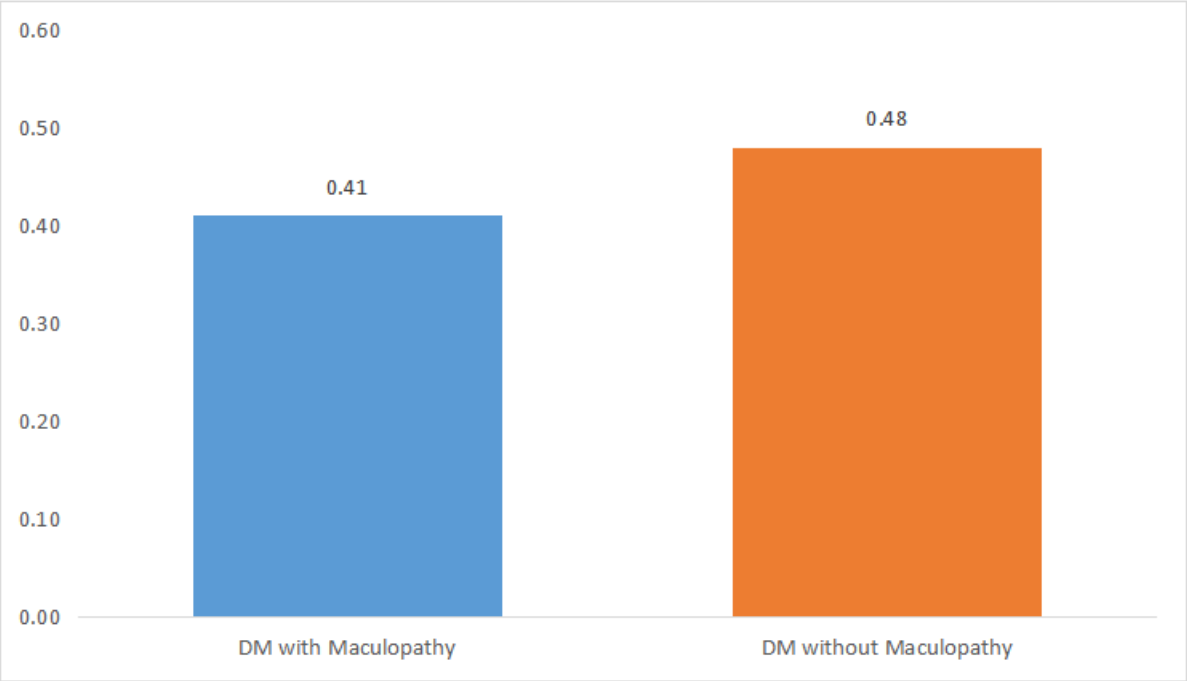


Table 2 describes mean comparison of visual acuity using Snellen's's at 4 meters between groups which was statistically significant with p=0.0001.

Table 3: Mean comparison of logMAR visual acuity at 6 meters between groups.

Group		Mean	Std. Deviation	P value
VA logMAR 6m	DM with Maculopathy	0.46	0.07	0.002
	DM without Maculopathy	0.50	0.03	

Graph 3 Mean comparison of logMAR visual acuity at 6 meters between groups

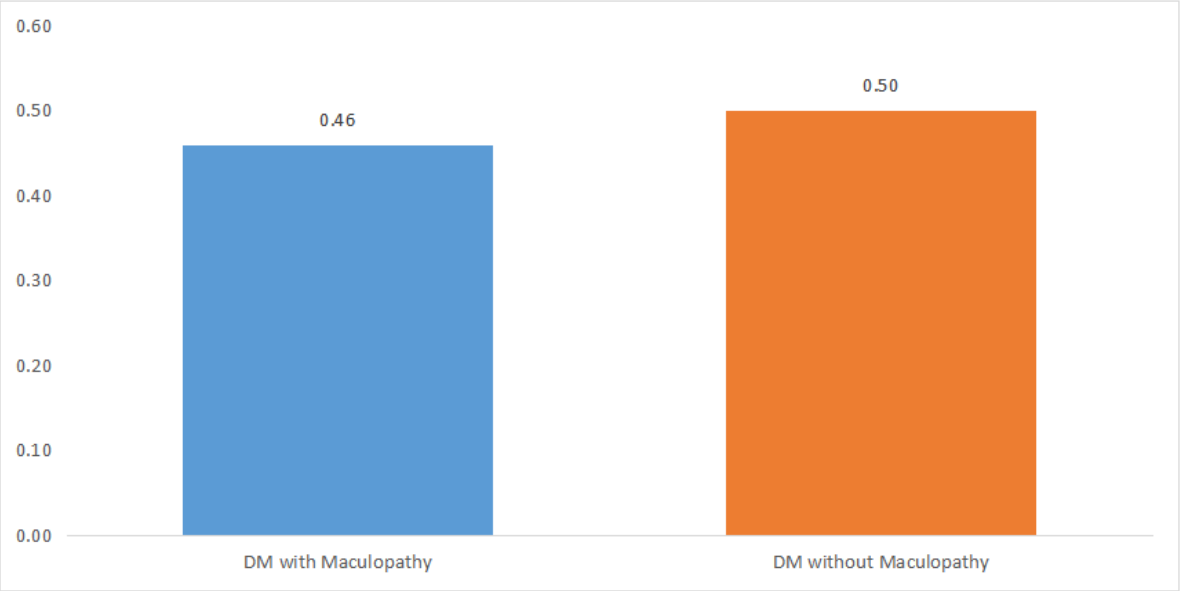


Table 3 describes mean comparison of visual acuity using logMAR at 6 meter which is statistically not significant with p=0.002.

Table 4 Mean comparison of visual acuity using Snellen's's chart at 6 meters between groups.

Group		Mean	Std. Deviation	P value
VA Snellen's 6m	DM with Maculopathy	0.38	0.06	<0.0001
	DM without Maculopathy	0.42	0.03	

Graph 4 Mean comparison of visual acuity using Snellen's's chart at 6 meters between groups

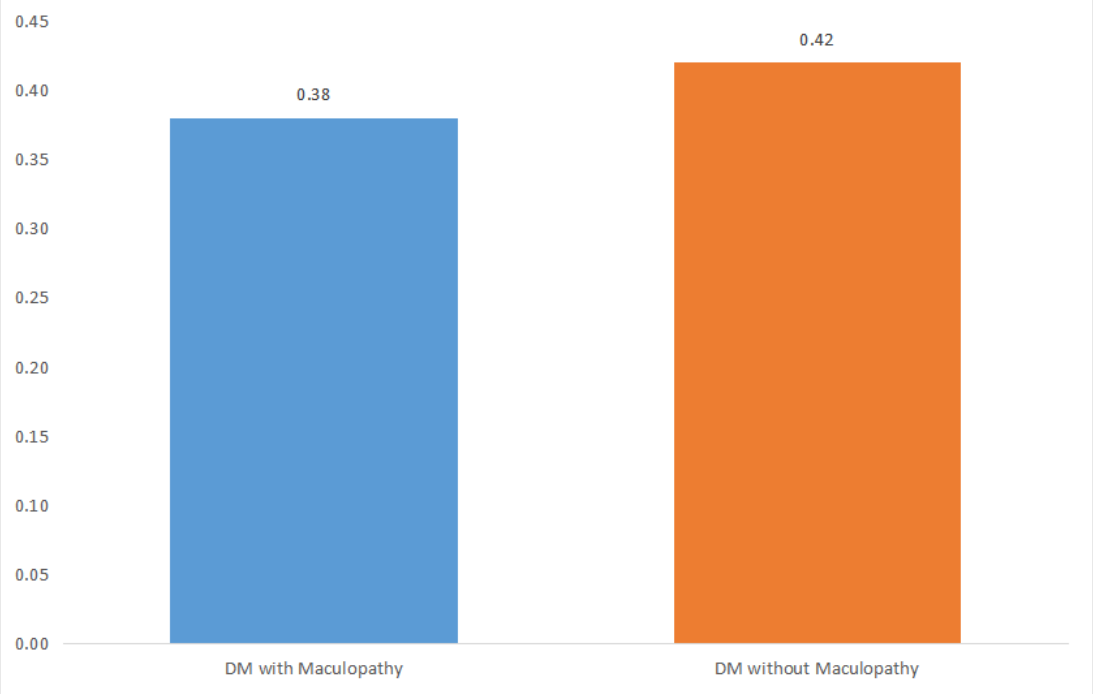


Table 4 describes mean comparison of visual acuity using Snellen's's chart at 6 meters between groups which is statistically significant with p<0.0001.

Table 5: Mean comparison of visual acuity using logMAR line score at 6 meters between groups

Group		Mean	Std. Deviation	P value
VA logMAR line score 6m	DM with Maculopathy	0.46	0.05	<0.0001
	DM without Maculopathy	0.50	0.03	

Graph 5:Mean comparison of visual acuity using logMAR line score at 6 meters between groups.

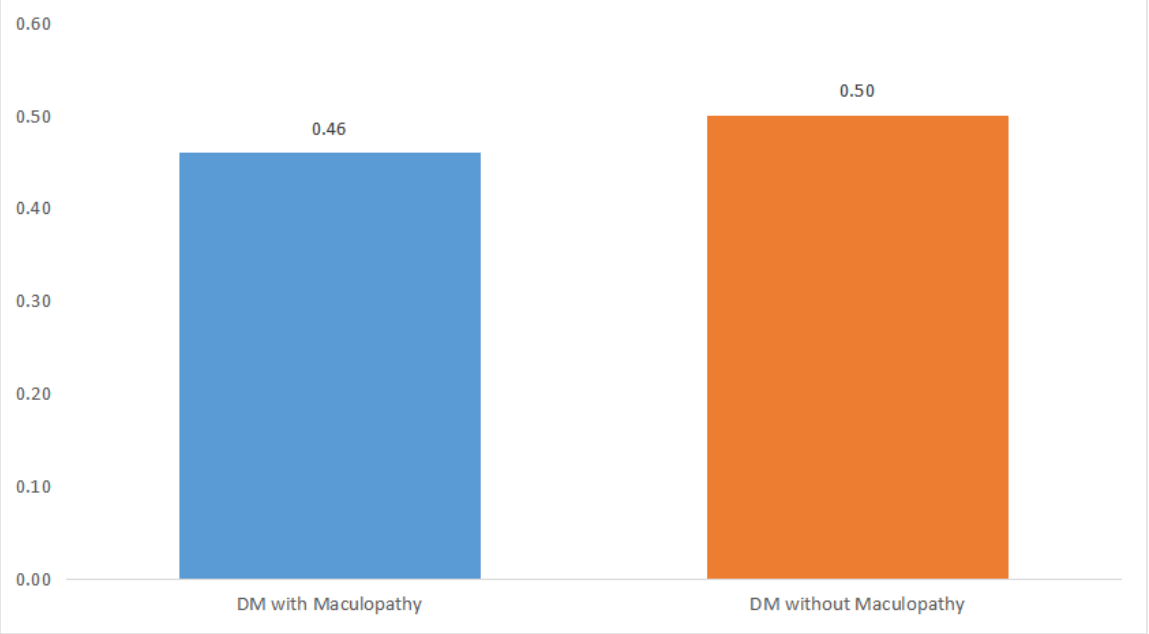


Table 5 describes the mean comparison of visual acuity using logMAR line score at 6 meter between groups which is statistically significant with P<0.0001.

Table 6: Mean comparison of visual acuity using logMAR letter score at 6 meters.

Group		Mean	Std. Deviation	P value
VA logMAR letter score 6m	DM with Maculopathy	0.68	0.12	<0.0001
	DM without Maculopathy	0.80	0.06	

Graph 6: Mean comparison of visual acuity using logMAR letter score at 6 meters.

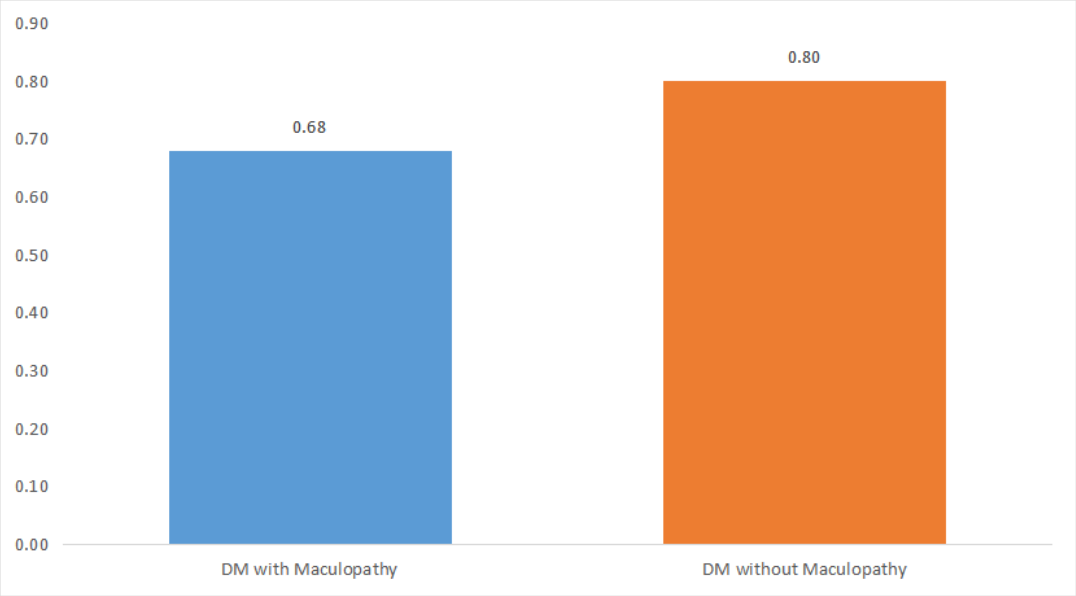


Table 6 describes mean comparison of visual acuity using logMAR letter score between groups which is statistically significant with P<0.0001.

Table 7: Mean comparison of visual acuity using logMAR chart and Snellen's's chart's with 4 meter in diabetes with maculopathy group.

Group		Mean	Std. Deviation	P value
DM with Maculopathy	VA logMAR 4m	0.60	0.12	<0.0001
	VA Snellen's 4m	0.41	0.08	

Graph 7:Mean comparison of visual acuity using logMAR chart and Snellen's's chart 4 meter in diabetes with maculopathy group.

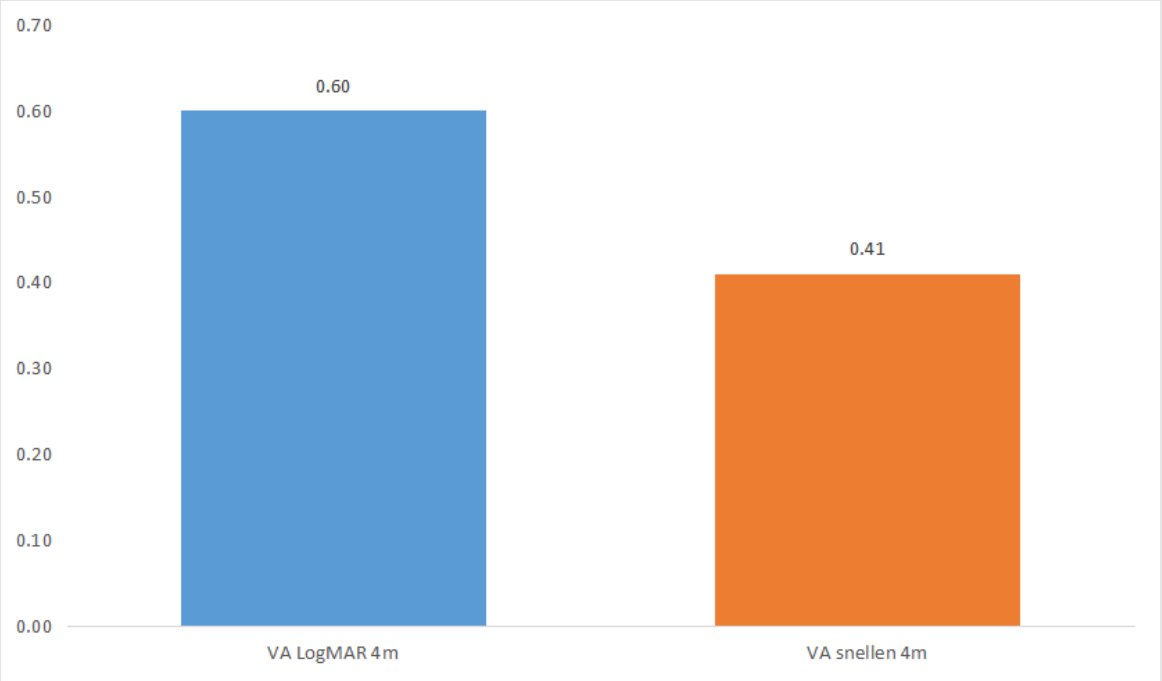


Table 7 describes mean comparison of visual acuity using logMAR and Snellen's's chart at 4 meters distance in diabetes maculopathy group which is statistically significant with P<0.001

Table 8: Mean comparison of visual acuity using logMAR and Snellen's's chart at 4 meter distance in diabetes without maculopthy group.

Group		Mean	Std. Deviation	P value
DM without Maculopathy	VA logMAR 4m	0.64	0.09	<0.0001
	VA Snellen's 4m	0.48	0.05	

Graph 8: Mean comparison of visual acuity using logMAR and Snellen's's chart at 4 meter distance in diabetes without maculopthy group.

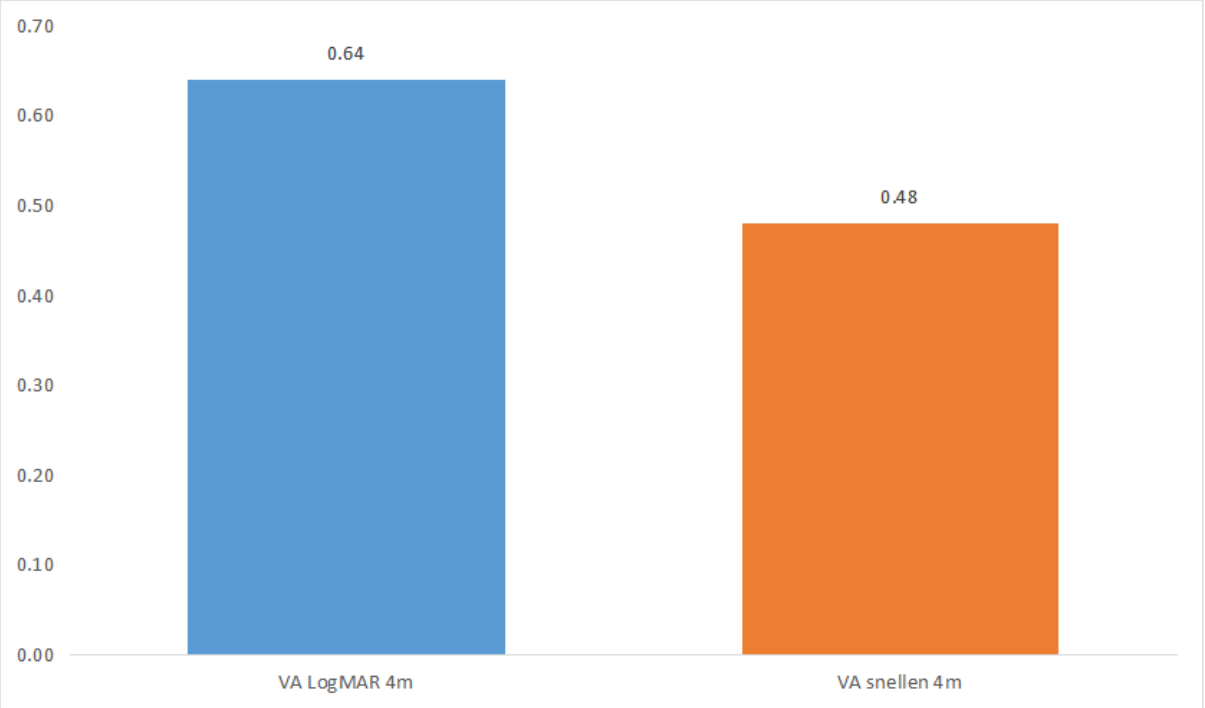


Table 9 describes the mean comparison of visual acuity using logMAR and Snellen's's chart at 4 meter distance in diabetes without maculopathy group which is statistically significant whit P<0.0001.

Table 9: Mean comparison of visual acuity using logMAR and Snellen's's chart's at 6 meters distance in diabetes with maculopathy group.

Group		Mean	Std. Deviation	P value
DM with Maculopathy	VA logMAR 6m	0.46	0.07	<0.0001
	VA Snellen's 6m	0.38	0.06	

Graph 9:Mean comparison of visual acuity using logMAR and Snellen's's chart's at 6 meters distance in diabetes with maculopathy group.

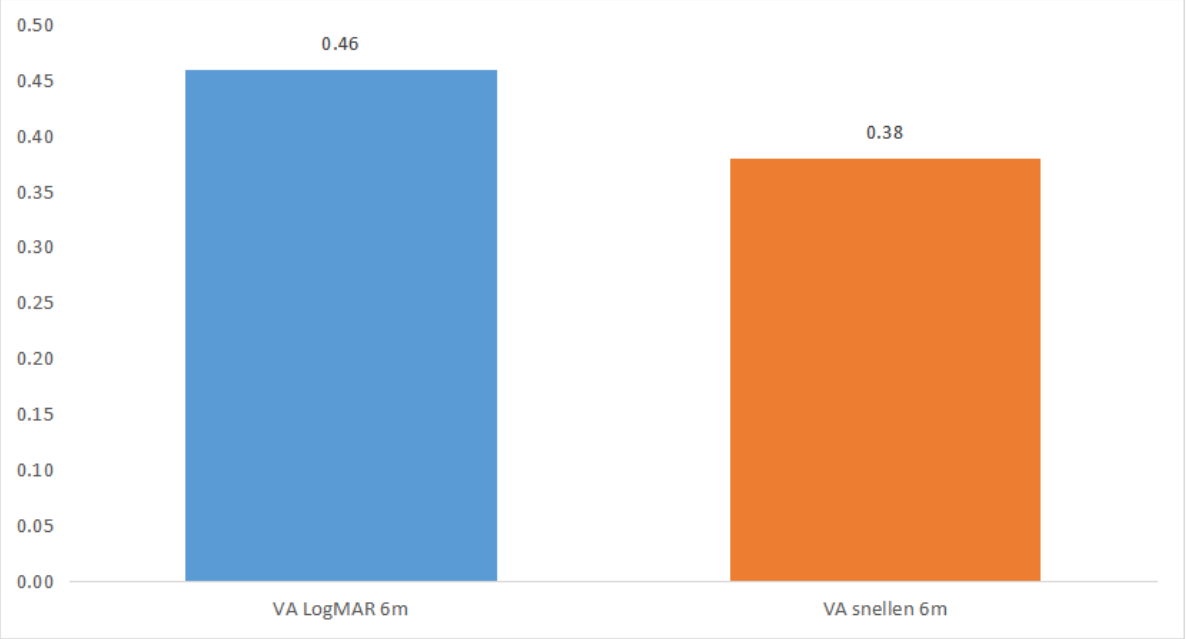


Table 9 describes mean comparison of visual acuity at 6 meters distance0 using logMAR and Snellen's's chart's in diabetes with maculopathy group which is statistically significant with P<0.0001.

Table 10: Mean comparison of visual acuity at 6 meters distance using logMAR and Snellen's's chart's in diabetes without maculopathy group.

Group		Mean	Std. Deviation	P value
DM without Maculopathy	VA logMAR 6m	0.50	0.03	<0.0001
	VA Snellen's 6m	0.42	0.03	

Graph10: Mean comparison of visual acuity at 6 meters distance using logMAR and Snellen's's chart's in diabetes without maculopathy group.

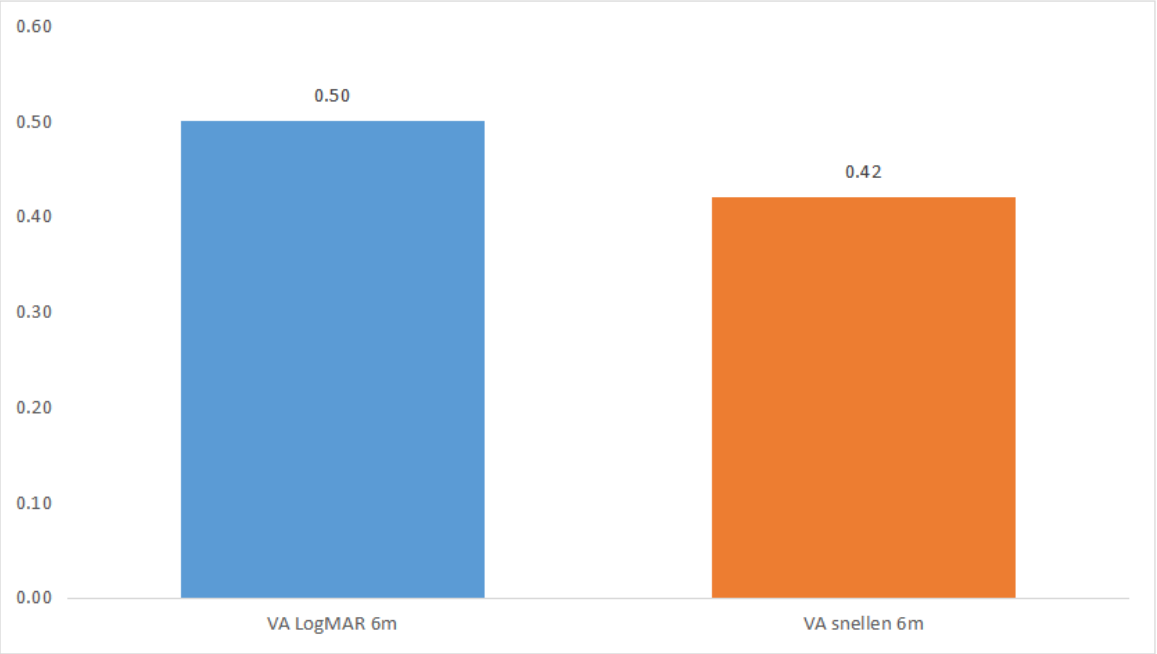


Table 10 describes the mean comparison of visual acuity at 6 meters distance using logMAR and Snellen's's chart's in diabetes without maculopathy group which is statistically significant with p<0.0001.

Table 11: Mean comparison of visual acuity at 6 meter with logMAR line score and letter score in diabetes with maculopathy group.

Group		Mean	Std. Deviation	P value
DM with Maculopathy	VA logMAR line score 6m	0.46	0.07	<0.0001
	VA logMAR letter score 6m	0.68	0.12	

Graph 11:Mean comparison of visual acuity at 6 meter with logMAR line score and letter scorein diabetes with maculopathy group.

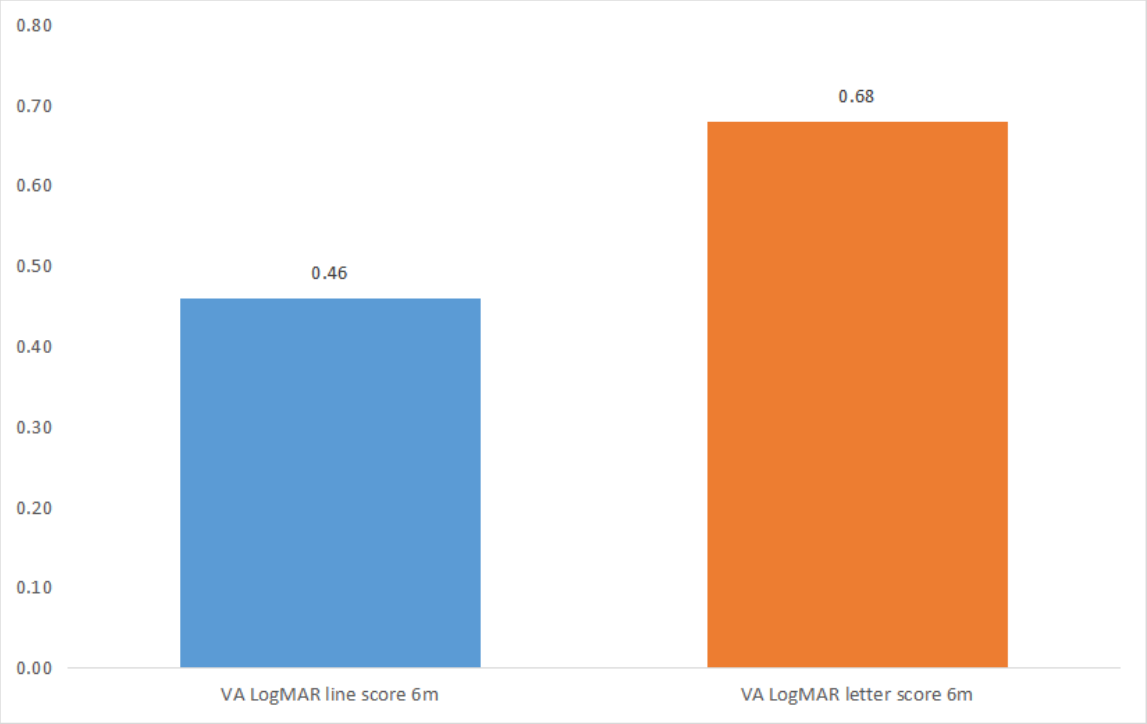


Table 11 describes mean comparison of visual acuity at 6 meters with logMAR line score and letter score in diabetes with maculopathy group which is statistically significant with P<0.0001.

Table 12: Mean comparison of visual acuity at 6 meters with logMAR line score and letter score in diabetes without maculopathy group.

Group		Mean	Std. Deviation	P value
DM without Maculopathy	VA logMAR line score 6m	0.50	0.03	<0.0001
	VA logMAR letter score 6m	0.80	0.06	

Graph 12: Mean comparison of visual acuity at 6 meters with logMAR line score and letter score in diabetes without maculopathy group.

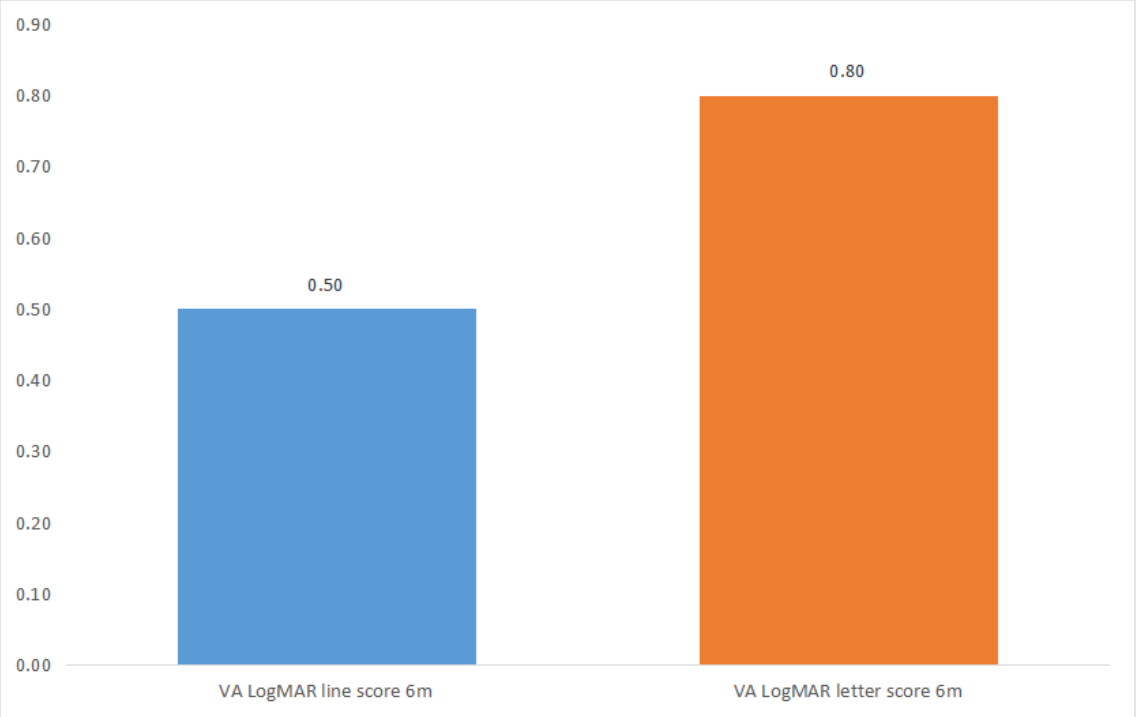


Table 12 describes mean comparison of visual acuity at 6 meters with logMAR line score and letter score in diabetes without maculopathy which is statistically significant with p<0.0001.

Summary

SUMMARY

The visual acuity assesed by logMAR line chart was more accurate and better than visual acuity assesed by Snellen's's acuity chart

When comparing visual acuity with logMAR line chart and Snellen's's visual acuity chart at 4meters,logMAR visual acuity is more accurate than Snellen's .Its value indicates better visual acuity in the form of one more line and few more letters in the next line.

When comparing visual acuity with logMAR and Snellen's charts at 6meters,logMAR visual acuity is more accurate than Snellen's,again it is better than Snellen'ss chart

When comparing logMAR line score and logMAR letter score ,logMAR letter score yields better accuracy than logMAR line score .

Similarly,diabetes maculopathy group having worse visual acuity in Snellen's's chart comparing to visual acuity in logMAR chart

Similarly diabetes without maculopathy groups having better visual acuity in logMAR chart compared to Snellen'ss chart

Both diabetes with and without maculopathy groups yielded better visual acuity in logMAR letter score than logMAR line score

Discussion

DISCUSSION

To our knowledge, this study represents the first direct attempt to compare and quantify the difference in VA measurements between the two of the most widely used charts for VA assessment. Such a comparison is important because of the rapidly emerging clinical trial and clinical case series data on treatment options for diabetic maculopathy as well as for other retinal diseases. The majority of the participants in our study were patients with various degrees of diabetic maculopathy. Others previously suggested, using much smaller number of patients, that there is a 3- to 4-line difference between the Snellen and LOGMAR chart in diabetic maculopathy patients with decreased VA.[23]

Clinicians are presented with the clinical trials data showing VA results measured with the LOGMAR chart, yet the majority of clinical case series published to date, as well as ophthalmologists' own VA outcomes, are measured with the standard Snellen chart. We emphasize that the LOGMAR chart gives less variable results[3,16,18–21] and it usually records a better VA than the Snellen chart under the same conditions owing to the well-described Snellen chart design flaws.[1–4,14] The Snellen chart has large gaps between lines in the low VA levels (<20/80), where the LOGMAR chart has equal smaller steps in line spacing at the same level of VA.

This difference obviously will result in some degree of discrepancy between visual scores recorded with both charts. Our study was designed to explore the practical impact of the visual results difference and clinically quantify it at the separate levels of acuity (Table 2). It is important to esti- mate this difference to help clinicians judge and compare VA results using the 2 different methods.

A better luminance level and a higher contrast of the letters play an important role for the spatial resolution.[24] In cases of diabetic maculopathy, contrast sensitivity is an especially impor- tant issue because macular function of these patients is impaired[25,26] and they require higher luminance and con- trast for letter recognition.[27] Others have shown that the reproducibility and sensitivity to small VA changes were poor with the Snellen chart and a luminance variation in different rooms further compromised the results.[3,6]

The 2 important advantages of the Snellen chart are the time required for the test and the convenient design for the refraction. The testing time for the Snellen chart is half the testing time for the LOGMAR chart.[10] These advan- tages, however, are not comparable for the problem in precision and accuracy, and therefore some guideline is necessary to interpret results of treatment studies, using the LOGMAR versus Snellen charts.

Although the LOGMAR chart has incorporated Snellen equivalent numbers and Snellen acuity results can be converted to logMAR equivalent ([—$\log MAR_{10}$[VA fraction]), it is important to realize that a simple mathematical conversion is misleading.

Our statistics show that the Snellen visual score was consistently lower (worse) than the LOGMAR visual score in the same eye across all ranges of vision, particularly in patients with visually significant diabetic maculopathy. As mentioned, the unequal line spacing between the 2 charts at the lower VA level is expected to result in some level of discrepancy of visual scores. However at the better levels of VA (S20/100) where the line spacing in both charts is similar, the differ- ence in VA scores is reduced but not totally eliminated. This should be taken into consideration when interpreting VA results in clinics.

There are several scoring methods have been described for the Snellen chart and we used a combination of the 2 most commonly used methods[12,29] to estimate VA more rigorously and with a higher precision for both low and high VA levels. Although we do acknowledge that there may be some contribution to the score difference from the scoring methods we used, it would not account for the full magni- tude of difference in the results we have shown. Also, given the large number of eyes used in our study and a high statistical significance of the results (<0.0001). Our data do not allow a strict conversion between the 2 methods on a patient-to-patient basis; however, statisti- cally the data we generated are very useful.

In this study, we focused on diabetic maculopathy because of the necessity to estimate visual outcomes properly during the course of treatment with currently available medications for maculopathy.Our data could be applicable to other diseases as well, but further studies in eyes with different ocular pathology may be performed.

Limitations

LIMITATIONS

Both LOGMAR and Snellen charts results or Equivocal or interchangeable. Although we did not analyse TRV, patients with poor vision in this study were significantly more likely to have better vision on the LOGMAR chart compared toSnellen charts.[59,60]

This study has several limitations, Including the fact that the tests were performed only once, so TRV could not be evaluated. Since this study was designed to evaluate vision testing using Snellen vs LOGMAR charts and not

TRV, repeatability and sensitivity could also not be tested in this study. The same examiner took all measurements in a short period of time under identical conditions to reduce the variability as much as possible.

Another option would have been to move the patient closer to the Snellen chart, but since the progression is not linear, the patient would have to be continuously moved as he or she read down the chart, and correlating the final vision would have been impractical.

Conclusion

CONCLUSION

The logMAR letter and line charts and Snellen's's visual acuity charts are efficient enough to detect the changes in the visual acuity caused by diabetic maculopathy except the logMAR chart being tested at 4meters which was showing insignificant p value. That is differentiating presence or absence of maculopathy in diabetes mellitus patients is not always possible when logMAR line chart was used at 4 meters.

Of the logMAR line vs logMAR letter chart's, the letter chart is able to pick up the finer aspect of visual acuity. Hence, wrongly labeling the patient with less visual acuity value could be avoided, whenever the Snellen's's 6 meter and the logMAR Line chart at 6 meter are indicative of lower visual acuity.

So the finer tool being the letter chart of logMAR but earlier identification of ongoing maculopathy while screening is better with Snellen's's visual acuity chart.

RECOMMENDATIONS

The study recommends,

1. In mass screenings, Snellen's's charts will be less time consuming than logMAR charts for both diabetic with and without maculopathy.

2. In a scenario rural diabetic patients failed to respond to logMAR charts, they can be educated and tested with logMAR charts for precise and accurate vision.

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Annexures

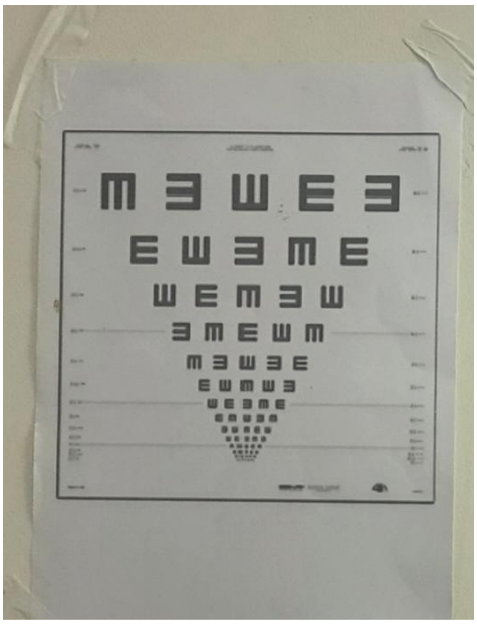
ANNEXURES

(NUMERICAL CHART)

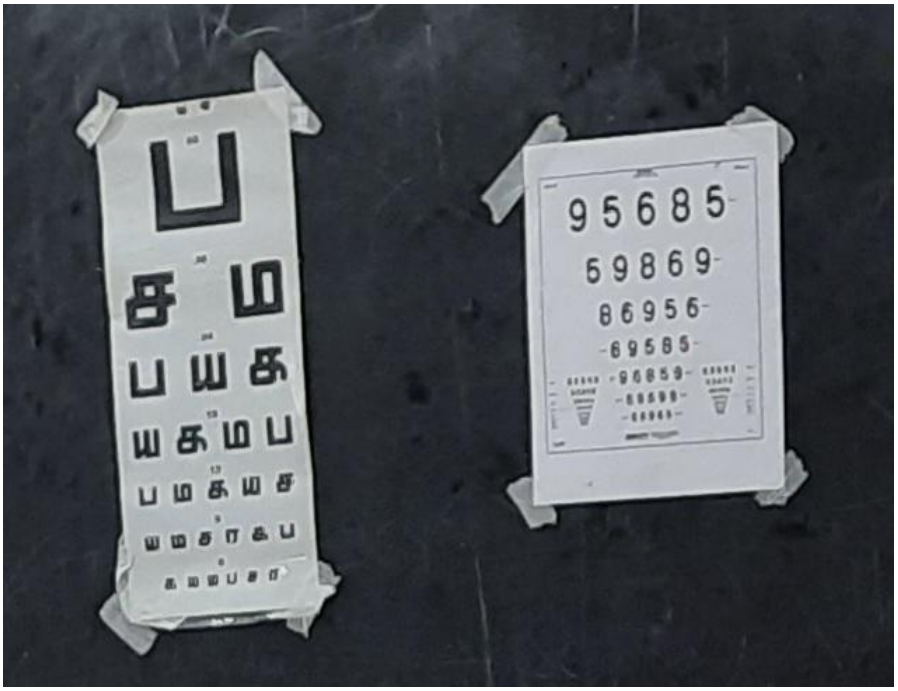
(TUMBLING E CHART)
(For illiterate)

SNELLEN CHARTS

REGIONAL TAMILETDRS CHART



TUMBLING E - ETDRSCHART (For illiterate)



SNELLEN AND ETDRS CHARTS

CASE PROFORMA

Name : Study ID No. :

Age: Date :

Sex:

Address:

Occupation:

Diabetic / Non-Diabetic: Duration of Diabetes:

Less than one year: Yes / No.

1 – 3 years Yes / No. Yes / No. Yes / No. Yes / No. Yes / No. Yes / No.

3 – 5 years

5 – 10 years

10 – 15 years

15 – 20 years

> 20 years

Chief Complaints :

Diminution of Vision [RE/LE]: Duration of illness :

Any other ocular symptoms :

Watering / Photophobia/ Headache:

O/E: General Examination: Vitals:Chest

CVS

Ocular Examination:Vision (VN):

Sl. No.	Snellen		ETDRS		Time		Distance at 4 Mtr				ETDRS Letter Score				llen Equivalent Letter score			
					Snellen	ETDRS	Snellen		ETDRS		Snellen		ETDRS		Snellen		ETDRS	
	RE	LE	RE	LE	BE	BE	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE

- Slit Lamp Examination : RE (Anterior Chamber)
  LE(Anterior Chamber)
- IOP : RE LE
- Fundus Examination : RE LE
- Fundus Photographs (if diabetic): Yes/ No
- Classification of diabetes: (NPDR, PDR, Advanced diabetic disease)
- Impression ascertaining to the stud

KEY TO MASTER CHART

ABBREVIATIONS

- DM - Diabetes Mellitus
- RE - Right Eye
- LE - Left Eye
- BE - Both Eye
- ETDRS - Early Treatment Diabetic Retinopathy Study
- LogMAR Value - Logarithmic Minimum Angle of Resolution Value

Master Chart

அறிவிக்கப்பட்ட முடிவு

தலைப்பு: ஸ்நெல்லன் (Snellan) மற்றும் லாக்மார் (logMAR) வரைபடங்களை பயன்படுத்தி நீரிழிவு விழித்திரை நோய் உள்ளவர்கள் மற்றும் விழித்திரை நோய் இல்லாதவர்கள் ஆகிய மக்களிடையே பார்வை நுண்ணுணர்வு ஒப்பீடு

முதன்மை ஆராய்ச்சியாளர்
மரு.மோ.ரம்யா
கண் மருத்துவர்

ஸ்டான்லி அரசு மருத்துவ கல்லூரி மற்றும் மருத்துவமனை சென்னை

ஆய்வுக்கு தேவையான தகவலை பெற ஒரு கட்டமைக்கப்பட்ட கேள்வித்தாள் நிர்வகிக்கப்படும் ஆய்வில் பங்கு சுமார் 15 நிமிடங்கள் உங்கள் மதிப்புமிக்க நேரம் நிமிடங்கள் தேவைப்படும் மற்றும்/ எந்த ஆக்கிரமிக்கும் செயல்முறை சேர்க்க முடியாது ஆய்வில் எந்த ஆபத்தும் இல்லை ஆய்வு பங்கேற்பு முற்றிலும் தன்னார்வ மற்றும் இரகசியத்தன்மை பராமரிக்கப்படும் எங்கள் இந்த ஆய்வில் கலந்து கொள்ளும் முன் உங்கள் ஒப்புதல் தேவைப்படுகிறது மற்றும் நீங்கள் இந்த ஆய்வில் இருந்து விலகுதல்/ விளக்குவதற்கான உரிமை உள்ளது.

நான் இந்த ஒப்புதலின் படிப்பை படித்துள்ளேன் இந்த ஆவணத்தின் உள்ளடக்கத்தை முழுமையாகப் புரிந்துகொண்டு, படிப்பில் கலந்துகொள்ள மனமுவந்து ஒப்புக்கொள்கிறேன். இந்த ஆய்வில் எனது எல்லா கேள்விகளுக்கும் பதிலளிக்க வேண்டும். இந்த ஆய்வில் எதிர்காலத்தில் எனக்கு ஏதேனும் சந்தேகங்கள் இருந்தால் மேலே பட்டியலிடப்பட்ட புலன்விசாரணை அவர்களுக்கு பதில் அளிக்கும் இந்த ஒப்புதலுடன் இந்த ஆய்வின் முடிவில் முடிவடைகிறது என்பதை நான் புரிந்துகொண்டேன் இந்த படிவத்தில் கையெழுத்து விடுவதன் மூலம் இந்த ஆய்வில் பங்கேற்ற நான் ஒப்புக்கொள்கிறேன்.

தேதி பங்கேற்பவர்கள் பெயர் & கையொப்பம்.

தகவல் தொடர்பாடல் சான்றிதழ்

மேலே குறிப்பிட்ட நபருக்கு இந்த ஆய்வின் தன்மையையும் நோக்கம் பற்றியும் நான் விளக்கினேன் இந்த ஆய்வு பங்கேற்பேன் சாத்தியமாக பயன்களை பற்றி விவாதித்தேன் என்று நான் சான் சொல்லிக்கிறேன் கேள்விகளுக்கு தனிப்பட்ட இந்த ஆய்வு பற்றி பதில் கிடைத்து மற்றும் எதிர்கால கேள்விகளை நாம் எப்பொழுதும் கிடைக்கும்

தேதி ஒப்புதல் பெறும் நபரின் கையப்பம்

_____

Informed consent:

Title: Mean comparison of visual acuity using Snellen and logMAR chart's between groups.

Principal Investigator
Dr.M.Ramya, P.G. resident

Department of Opthalmology
Govt Stanley Medical College & Hospital, Chennai.

A structural questioner will be administrated to get necessary information for the study.The participation in this study will require approximately 10 minutes of your valuable time and it does not include any invasive procedure. There are no risks involved in the study. Participation in the study is completely voluntary and confidentiality will be maintained your comment is required before you can participate in this study and you have the right to refuse/withdraw from this study.

I have read this consent form and I fully understand the content of this document and voluntarily consent to participate in the study. All of my question concerning this study have to be answered. If I have any questions in the the future about this study the investigated listed above will answer them. I understand that this consent and at the conclusion of the study. By signing this form. I agree to participate in this study.

Date: participants name & signature

DM with maculopathy

sl.no	name	op no	age/sex	DM in yrs	snellens	ETDRS (Log mar values)	snellens decimal equalent	time		DISTANCE 4 MTR		LETTER SCORE (4MTR)	
								snellen	ETDRS	ETDRS	snellen	snellen	ETDRS
1	Amudha	299010	55/F	5	RE 6/18p	0.5	0.33	105	225	0.54	0.33	20/60	60
2	Amudha	299010	55/F	5	LE 6/18l	0.25	0.33	105	225	0.34	0.33	20/60	60
3	Anjalai	308821	60/F	6	RE 6/36	0.8	0.19	90	210	0.8	0.25	20/125	45
4	Anjalai	308821	60/F	6	LE 6/18	0.8	0.33	90	210	0.54	0.5	20/60	60
5	Chithra	306694	58/F	8	RE 6/24 P	0.6	0.25	60	150	0.6	0.25	20/80	56
6	Chithra	306694	58/F	8	LE 6/24	0.6	0.25	60	150	0.6	0.25	20/80	58
7	Arjunan	308540	30/M	3	RE 6/6	0.0	1	80	180	0	1	20/20	88
8	Arjunan	308540	30/M	3	LE 6/6	0.0	1	80	180	0	1	20/20	88
9	Kannan	171875	45/M	2	RE 6/18	0.5	0.33	60	180	0.5	0.33	20/60	59
10	Kannan	171875	45/M	2	LE 6/24	0.6	0.25	60	180	0.8	0.17	20/120	44
11	Dhanalakshmi	308969	47/F	1.5	RE 6/18	0.5	0.33	90	180	0.5	0.33	20/60	60
12	Dhanalakshmi	308969	47/F	1.5	LE 6/18	0.5	0.33	90	180	0.5	0.33	20/60	60
13	Alagammal	234916	54/F	7	RE 6/60	1	0.08	180	300	1	0.1	20/200	36
14	Alagammal	234916	54/F	7	LE 6/36	6	0.17	180	300	0.8	0.17	20/120	46
15	Velu	307650	60/M	5	RE 6/60	1.6	0.10	130	240	1	0.1	20/200	36
16	Velu	307650	60/M	5	LE 6/36	0.6	0.17	130	240	0.8	0.17	20/120	46
17	Madhan	2175848	52/M	2 MONTHS	RE 6/9	0.2	0.03	70	160	0.2	0.63	20/30	74
18	Madhan	217848	52/M	2 MONTHS	LE 6/9 P	0	1	70	160	0.2	0.63	20/30	74
19	Jeyaraj	293744	51/M	2	RE 6/6	0	0.63	180	280	0	1	20/20	88
20	Jeyaraj	293744	51/M	2	LE 6/9 P	0.2	1	180	280	0.2	0.63	20/30	78
21	Sethuraman	908017	59/M	3	RE 6/12	0.2	0.5	110	200	0	1	20/20	88
22	Sethuraman	308017	59/M	3	LE 6/18	0.5	0.33	110	200	0.2	0.63	20/30	78
23	Ramu	307253	53/M	5	RE 6/24 P	0.6	0.25	100	180	0.3	0.5	20/40	88
24	Ramu	307253	53/M	5	LE 6/36	0.8	0.17	100	180	0.5	0.33	20/60	78
25	Komala	308070	55/M	10	RE 6/60	1	0.10	140	300	0.6	0.25	20/80	69
26	Komala	308070	55/M	10	LE 6/36	0.8	0.17	140	300	0.8	0.17	20/120	60
27	Kaliammal	306281	58/F	15	RE 6/60	1	0.08	180	300	1	0.1	20/200	56
28	Kaliammal	306281	58/F	15	LE 6/36	0.6	0.17	180	300	0.8	0.17	20/120	46
29	Ashok	302856	41/M	3	RE 6/6	0	1	90	130	1	0.1	20/200	36
30	Ashok	302856	41/M	3	LE 6/6 P	0	0.8	90	130	0.8	0.17	20/120	46
31	Nagammal	314173	56/F	5	RE 6/30	0.8	0.17	120	220	0	1	20/20	36
32	Nagammal	314173	56/F	5	LE 6/24	0.6	0.25	120	220	0	1	20/20	46
33	Padma	314189	37/F	8	RE 6/36	0.8	0.17	95	135	0.8	0.25	20/125	88

34	Padma	314189	37/F	8	LE 6/18	0.5	0.33	95	135	0.6	0.25	20/80	86
35	Rajeshwari	310009	56/F	8	RE 6/60	1	0.33	160	270	0.3	0.17	20/120	45
36	Rajeshwari	310009	56/F	8	LE 6/36	0.8	0.17	160	270	0.5	0.33	20/60	58
37	Chandran	314100	60/M	5	RE 6/60	1	0.13	160	270	1.0	0.1	20/200	44
38	Chandran	314100	60/M	5	LE 6/60	0.8	0.17	160	270	0.8	0.17	20/120	60
39	Chinna Ponnu	303020	59/F	2	RE 6/9	0	1	70	120	1	1	20/250	34
40	Chinna Ponnu	303020	59/F	2	LE 6/9 P	0	1	70	120	1	0.1	20/50	44
41	Balan	314066	54/M	4	RE 6/24	0.6	0.25	148	272	0.2	0.63	20/30	29
42	Balan	314066	54/M	4	LE 6/9 P	0.2	0.63	148	272	0.2	0.8	20/25	29
43	Vijaya	302856	49/F	6	RE 6/36	0.8	0.14	160	285	0.6	0.25	20/80	74
44	Vijaya	302856	49/F	6	LE 6/24 P	0.6	0.25	160	285	0.2	0.8	20/125	83
45	Anbumani	271383	48/M	8	RE 6/36	0.8	0.14	160	20	0.8	0.25	20/125	56
46	Anbumani	271383	48/M	8	LE 6/24 P	0.6	0.50	160	270	0.6	0.25	20/80	83
47	Pandiyan	314185	64/M	7	RE 6/12	0.2	0.50	160	250	0.8	0.25	20/125	45
48	Pandiyan	314185	64/M	7	LE 6/36	0.8	0.20	160	250	0.6	0.25	20/80	56
49	Anandhan	293434	35/M	2	RE 6/9	0.2	0.63	120	170	0.3	0.5	20/30	74
50	Anandhan	293434	35/M	2	LE 6/12 P	0.3	0.50	120	170	0.6	0.25	20/80	56
51	Renuka	294057	39/F	5	RE 6/18	0.5	0.33	130	290	0.2	0.63	20/30	74
52	Renuka	294057	39/F	5	LE 6/12	0.3	0.5	130	290	0.3	0.5	20/40	70
53	Balamurugan	31076	62/M	3	RE 6/60	1	0.1	130	240	0.5	0.33	20/60	60
54	Balamurugan	310716	62/M	3	LE 6/36	0.6	0.17	130	240	0.3	0.5	20/40	69
55	Sivakumar	310005	56/M	4	RE 6/9	0.2	0.8	70	130	1.0	0.1	20/200	34
56	Sivakumar	31000	56/M	4	LE 6/12	0.3	0.63	70	130	0.8	0.17	20/120	44
57	Mutharasan	304910	51/M	1	RE 6/6	0	1	60	120	0.2	0.63	20/30	78
58	Mutharasan	304910	51/M	1	LE 6/9 P	0.2	0.8	60	120	0.3	0.5	20/40	70
59	Govindhammal	2174489	48/F	8	RE 6/24	0.6	0.25	160	270	0	1	20/20	88
60	Govindhammal	2174489	48/F	8	LE 6/36	0.8	0.27	160	270	0.2	0.63	20/30	78
61	Kumar	293434	46/M	10	RE 6/60	1	0.1	130	240	1	0.1	20/200	34
62	Kumar	293434	46/M	10	LE 6/36	0.6	0.17	130	240	0.8	0.17	20/120	44
63	Perumal	310806	56/M	3	RE 6/6	0	1	80	140	0	1	20/20	88
64	Perumal	310806	56/M	3	LE 6/6 P	0	0.8	80	140	0	1	20/20	86
65	Selvi	310754	51/F	10	RE 6/60	1	0.6	130	240	1	0.1	20/200	34
66	Selvi	310754	51/F	10	LE 6/36	0.6	0.17	130	240	0.8	0.17	20/120	44
67	Parvathy	3037121	59/F	6	RE 6/8	0.5	0.33	130	290	0.5	0.33	20/60	60
68	Parvathy	3037121	59/F	6	LE 6/12	0.3	0.5	130	290	0.3	0.5	20/40	69
69	Karpagam	298110	4//F	12	RE 6/12	0.2	0.50	160	250	0.3	0.5	20/30	74
70	Karpagam	298110	4//F	12	LE 6/30	0.8	0.20	160	250	0.6	0.25	20/80	56

DM WITHOUT MACULOPATHY													
71	Selvi	282543	56/F	2	RE 6/24	0.6	0.29	40	120	0.6	0.25	20/80	56
72	Selvi	282543	56/F	2	LE 6/9	0.2	0.8	40	120	0.2	0.63	20/30	74
73	Rani	297297	42/F	4	RE 6/6	0	1	60	14	0	1	20/20	88
74	Rani	297297	42/F	4	LE 6/18	0.5	0.33	60	14	0.54	0.5	20/60	60
75	Egavlli	350661	31/F	6	RE 6/6 P	0	1	40	120	0	1	20/25	80
76	Egavlli	2350661	31/F	6	LE 6/18 P	0.5	0.4	40	120	0.5	0.4	20/60	63
77	Meena	310733	63/F	7	RE 6/9	0.2	0.8	70	140	0.2	0.63	20/30	74
78	Meena	310733	63/F	7	LE 6/6 P	0	1	70	140	0	1	20/25	80
79	Nagappan	311055	52/M	2	RE 6/6 P	0	1	100	210	0	1	20/25	80
80	Nagappan	311055	52/M	2	LE 6/9 P	0.2	0.8	100	210	0.2	0.63	20/30	78
81	Bharathi	272422	53/M	1 MONTH	RE 6/9	0.2	0.63	70	120	0.2	0.63	20/30	78
82	Bharathi	272422	53/M	1 MONTH	LE 6/6	0	1	70	120	0	1	20/20	88
83	Poongothai	311126	68/F	1 MONTH	RE 6/9	0.3	0.5	120	220	0.2	0.63	20/30	76
84	Poongothai	311126	68/F	1 MONTH	LE 6/12	0.2	0.63	120	220	0.3	0.5	20/40	70
85	Tharamani	311129	57/M	2	RE 6/9 P	0.2	0.8	65	170	0.2	0.8	20/25	82
86	Tharamani	311129	57/M	2	LE 6/12	0.3	0.5	65	170	0.3	0.5	20/40	72
87	Maritha	311153	53/F	3	RE 6/6 P	0	0.8	40	90	0	1	20/20	86
88	Maritha	311153	53/F	3	LE 6/9	0.2	0.63	40	90	0.2	0.63	20/30	74
89	Vasanth	294059	45/M	6 MONTHS	RE 6/6	0	1	40	80	0	1	20/20	88
90	Vasanth	294059	45/M	6 MONTHS	LE 6/6 P	0	0.8	40	80	0	1	20/20	86
91	Esha	309473	52/F	1	RE 6/9	0.2	0.63	95	170	0.2	0.63	20/30	74
92	Esha	309473	52/F	1	LE 6/18	0.5	0.33	95	170	0.5	0.33	20/60	60
93	Raman	2788407	56/M	3	RE 6/9	0.2	0.63	40	90	0.2	0.63	20/30	78
94	Raman	2788407	56/M	3	LE 6/12	0.3	0.5	40	90	0.3	0.5	20/40	70
95	Maheshwari	282867	59/F	8 MONTHS	RE 6/6 P	0	1	50	100	0	1	20/20	86
96	Maheshwari	282867	59/F	8 MONTHS	LE 6/9 P	0.2	0.8	50	100	0.2	0.63	20/30	78
97	Vijayan	311628	53/M	2 MONTHS	RE 6/9	0.3	0.50	80	160	0.34	0.5	20/40	72
98	Vijayan	311628	53/M	5 MONTHS	LE 6/12	0.2	0.60	80	160	0.2	0.63	20/30	76
99	Kokila	304531	48/F	1	RE 6/9	0.2	0.63	50	100	0.2	0.63	20/30	76
100	Kokila	304531	48/F	1	LE 6/6 P	0	1	50	100	0	1	20/20	87
101	Murali	312229	62/M	3	RE 6/2	0.3	0.50	60	130	0.3	0.5	20/40	70
102	Murali	312229	62/M	3	LE 6/18	0.5	0.33	60	130	0.5	0.33	20/60	62
103	Sasikala	312255	50/F	1	RE 6/6	0	1	50	0	0	1	20/20	86
104	Sasikala	312255	50/F	1	LE 6/6	0	1	50	90	0	1	20/20	88
105	Malliga	312065	42/F	6 MONTHS	RE 6/6	0	1	50	95	0	1	20/20	8
106	Malliga	312065	42/F	6 MONTHS	LE 6/6 P	0	0.8	50	95	0	0.8	20/25	81

107	Antony Raj	311736	46/M	2	RE 6/9	0.2	0.63	120	250	0.2	0.63	20/30	76
108	Antony Raj	311736	46/M	2	LE 6/24	0.6	0.25	120	250	0.6	0.25	20/80	56
109	Boopathy	312215	51/M	3	RE 6/6	0	1.0	70	120	0	1	20/20	88
110	Boopathy	312215	51/M	3	LE 6/6 P	0	0.80	70	120	0	0.8	20/25	82
111	Anandan	293423	62/M	10	RE 6/24	0.6	0.25	130	220	0.6	0.25	20/80	56
112	Anandan	293423	62/M	10	LE 6/36 P	0.8	0.20	130	220	0.8	0.17	20/120	48
113	Kanniga	307122	56/F	3 MONTHS	RE 6/9	0.2	0.63	120	210	0.2	0.8	20/25	80
114	Kanniga	307122	56/F	3 MONTHS	LE 6/9	0.2	0.63	120	210	0.2	0.8	20/25	80
115	Vimala	312148	57/F	6	RE 6/24	0.6	0.25	120	205	0.6	0.25	20/80	55
116	Vimala	312148	57/F	6	LE 6/12	0.3	0.50	120	205	0.3	0.5	20/40	72
117	Uma	312140	42/F	8 MONTHS	RE 6/6 P	0	1	85	145	0	1	20/20	88
118	Uma	312140	42/F	8 MONTHS	LE 6/9	0.2	0.63	85	145	0.2	0.8	20/25	80
119	Yuvarani	227545	59/F	1	RE 6/24	0.6	0.25	100	200	0.6	0.25	20/80	58
120	Yuvarani	227545	59/F	1	LE 6/18	0.5	0.33	100	200	0.56	0.33	20/60	59
121	Amala	304420	61/F	3	RE 6/18	0.5	0.33	140	280	0.56	0.33	20/20	59
122	Amala	304420	61/F	3	LE 6/24	0.6	0.25	140	280	0.64	0.25	20/80	54
123	Duraibabu	312280	53/M	2	RE 6/9	0.2	0.63	75	138	0.2	0.63	20/30	76
124	Duraibabu	312280	53/M	2	LE 6/6	0.0	1	75	138	0	1	20/20	88
125	Prakash	312812	41/M	5	RE 6/18	0.5	0.33	140	280	0.56	0.33	20/60	59
126	Prakash	312812	41/M	5	LE 6/24	0.6	0.25	140	280	0.64	0.25	20/80	54
127	Krishnan		38/M	7	RE 6/9	0.2	0.63	120	210	0.2	0.8	20/25	80
128	Krishnan		38/M	7	LE 6/9	0.2	0.63	120	210	0.2	0.8	20/25	78
129	Shanthi	362993	35/F	9 MONTHS	RE 6/6	0.0	1	45	90	0	1	20/20	88
130	Shanthi	362993	35/F	9 MONTHS	LE 6/9	0.2	0.63	45	90	0.2	0.8	20/25	76
131	Ramani	871641	55/F	7	RE 6/18	0	1	55	100	0.5	0.33	20/60	60
132	Ramani	871641	55/F	7	LE 6/24	0.6	0.3	55	100	0.6	0.25	20/80	58
133	Sivakumar	314622	62/M	12	RE 6/36	0.8	0.17	120	240	0.8	0.17	20/120	44
134	Sivakumar	314622	62/M	12	LE 6/36	0.8	0.17	120	240	0.8	0.17	20/120	46
135	Pandiyan	289711	56/M	6	RE 6/24	0.6	0.5	120	240	0.6	0.25	20/80	58
136	Pandiyan	289711	56/M	6	LE 6/18	0.5	0.99	120	240	0.5	0.33	20/60	60
137	Padma	265625	48/F	1	RE 6/12	0.3	0.5	96	184	0.5	0.5	20/40	69
138	Padma	265625	48/F	1	LE 6/9 P	0.2	0.8	96	184	0.2	0.63	20/30	79
139	Elumalai	274220	52/M	4	RE 6/18	0.5	0.33	90	180	0.5	0.33	20/60	60
140	Elumalai	274220	52/M	4	LE 6/9 P	0.2	0.80	90	180	0.2	0.63	20/30	74