OCCURRENCE OF VISION RELATED CONDITIONS & EFFICACY OF VISION THERAPY ON THE PERFORMANCE OF SLOW LEARNER STUDENTS

[1]Somdatta Maitra, [2]Dipti Gogate

[1]Assistant professor, [2]Former assistant professor
[1]Optometry and vision science,
[1]N.S.H.M knowledge Campus, Kolkata,India

Abstract:

Aim: To find the occurrence of visual related conditions that affect the performance of slow learner in the school & efficacy of vision therapy on their performance.

Materials &method: -Total of 130 students of a slow learner school were screened and examined. Out of 130, 32 students of 8 to 23 years of age who had visual skill defects were selected for a comprehensive examination with more stress on ocular motility, accommodative facility, saccades, reading rate and hand eye coordination. Student's performance was also evaluated before and after the vision therapy with the help of questionnaire answered by parents and teachers.30 in office sitting for 45 minutes allotted for each student, and home vision therapy procedure was also explained to the parents. Complete visual skill examination was performed after 15th and 30th sitting.

Results: -Out of 130, 32 students were found to have visual skill related defects.66 were normal and rest 32 students had other vision related conditions. Two type of statistical analysis under SPSS version17.0 shows strong statistical correlation (p<0.05) which also show its clinical significance.

Conclusion: - slow learner students have visual skill related difficulties like normal students. Considering the IQ level of slow learners, the duration of vision therapy should be more to achieve the desired result. This study shows vision therapy significantly improves their academic performance & daily routine activities, by simply working on their visual skills. This improvement in their performance has helped in boosting their confidence & acceptance in family & in sociallife.

Keywords: -slow learner, vision therapy, visual skill, reading rate

I. INTRODUCTION

Slow learner children who are doing poorly in normal school, yet are not eligible for special education. Their intelligence test scores too high for consideration as mentally challenged child. A slow learner is difficult to identify because he/she is no different in appearance & can function normally in most situation. He/she usually has normal physical dexterity.[1,2,3,4,5,6]
As these students are tagged as "slow learner" students they always feel isolated from the kid those who are in normal school they are also feel inferior than family members of same age who are leading a normal lifestyle like other child, teenagers or adults so they are very much depressed and feel neglected. Not only this child their family members also going through a depressed phase so we when we were dealing with these children. we make sure that we have to be little bit more careful when handling such cases[7,3,4]

They lack in performance in academics, sports, & as well as daily living activities for various reason .Though their IQ between 70-90 their slow performance may be because of poor or under developed visual skill like auto focusing, tracking an object, smooth and fast ocular movement, blurring of near vision lesser reading rate while reading comprehended the reading material.[9] Slow learner students those who

have uncorrected or corrected visual acuity of 6/6 or 6/9 does not mean that they are having strong visual system. Because visual acuity is just one of the components of various visual skill .so, in that case they might be lacking some very useful part of visual skill which can be improved through visiontherapy.[11]

By American optometry association vision therapy is "the systemic use of lenses, prisms, filters, occlusion, &other appropriate material modalities, equipment & procedure is integral to optometric vision therapy. the goal of the prescribe treatment regimen are to alleviate the sign, symptoms, achieve desired visual outcomes meet the patient's need & improve the patient's quality of life"[8]

Human's brain is very complicated structure and all the sensory, motor& intellectual level are controlled by the brain. So, there can be other conditions of the brain which affect the reading &
writing skills[20] slow learner students who having defective visual skills can be helped by comprehensive visual examination hence they can improve their performance really help them with vision therapy(depending on the type of problem they have) Though we may not expect a marked change but still proper remedial exercise can change their academic performance and other activities, this improvement helps to build a great confidence level in them .[10]

AIM: -To find the occurrence of visual related conditions that affect the performance of slow learners in the school& efficacy of vision therapy on their performance.

OBJECTIVE: -
1.Find the occurrence of refractive error among slow learner students

2.Compare visual skill pre & post vision therapy

3.Compare reading rate pre & post vision therapy

4.To evaluate the changes in school performance & quality of life pre & post vision therapy with the help of questionnaire to teachers or students.

II. RESEARCH QUESTION:

How many slow learner students have refractive & visual skill or orthoptic related problems? What is the efficacy of vision therapy in academic overall performance in slow learner students?
NEED FOR THE STUDY: -There is not much work done with optometric intervention on slow learner student. We are still in dark with our limited knowledge in this field. These children are neglected and separated from the main stream of life. We cannot change the complex structure of the brain which is already developed but the students having the problem of visual skill which create a negative effect on their reading and writing obviously can change by vision therapy.

III. REVIEW OF LITERATURE:

Efficiency of reading as measured by reading rate was increased more rapidly during the period of vision therapy. Reading rate gains were maintained during the post vision therapy period. In two of three cases further rate gains were observed during the post vision therapy period.
Gary Sigler,ED.D,D.ToddWylee,OD;The effect of vision therapy on reading rate :a pilot study .J.of Behavioral optometry1994

When 11 special schools are examined in Pune to treat ocular disorders in children with learning disabilities & explore associations with their perinatal history, it found that nearly half the children in this study had ocular disorders & one fourth had their vision improved.
Parikshit Gogate.et.al;Ocular disorders in children with learning disabilities in special education school of Pune.India;Indian J.othalmal.2011; May-jun;59(3):223-228

It has been proved that orthoptic treatment is an effective treatment for those who do not respond well in standard treatment & primary treatment in case with asthenopic symptoms/or convergence insufficiency.
Atzmon D,NemetP,IshayA,KarniE.arandomizedprospectivemasked and matched comparative study of orthoptic treatment Vs conventional reading tutoring treatment for reading disabilities in 62 children .Binocular vision and Eye Muscle surgery Quarterly 8(2):91-106,1993

A vision screening was performed on 80 disabled readers to examine the incidence of specific peripheral visual anomalies so as to isolate those visual anomalies most commonly found in this population, thus forming a visual profile of the disabled readers. from this study examiner found higher percentage of failures in tests of accommodation, fusion, oculomotor skills relative to visual acuity, refractive error & ocular pathology, and also concluded that there is need for comprehensive vision screening to detect those vision problems known to most commonly exist in the disabled readers.
ChernikB.profile of peripheral visual anomalies in the disabled reader Am Optom Assoc;1978 Oct;49(10):1117-8

After total investigation of 87 poor readers & 32 control children this study provides data on accommodative capacity of a population of children with reading difficulties. Findings suggest a reduced monocular accommodative amplitude & binocular accommodative facility. So, it suggests that children whose reading level in below average should check their accommodative facility by an optometrist clinician
Palamo-Alvarez C,PuellMC.*accomodative function in school children with readingdifficultiesGraefes Arch clin Exp opthalmol;2008 Dec;246(12):1769-74;Epub 2008 Aug28*

In this study they have investigated that Vision therapy is helpful in reduction of reading stress, which will help to increase reading ability of the patient.
Forrest EB,approaching vision training :its impact on learning's Optom vision Devel,1982

Researches have investigated the efficacy of vision therapy for visual perception, visual discrimination, vision as related to IQ and achievement in different aspects.
Solan H et.al a case report on a grade one children before & after perceptual –motor training J learning disabilities1970

It has been studied that there is a positive effect of vision therapy on change in the vision related performance of subjects as it improves oculomotor& visual skill of the patients.

Flax N et al the contribution of visual problem to learning disabilities J Optom 1970

Health T et al eye exercises & reading efficacy Acad therapy 1976

STUDY DESIGN: -Prospective single centered study

DURATION: -4 month

STUDY CENTER: -Vidya Joyti special school, PUNE

SAMPLE SIZE: -total 130 students were screened and from them 32 students (8-23) year of age & IQ of 70-90) were selected. They are diagnosed as slow learner by the 6 team of experts from KEM hospital, PUNE.

INCLUSION CRITERIA: -

IQ range 70-90

Corrected visual acuity of 6/9 or better in each eye

EXCLUSION CRITERIA: -

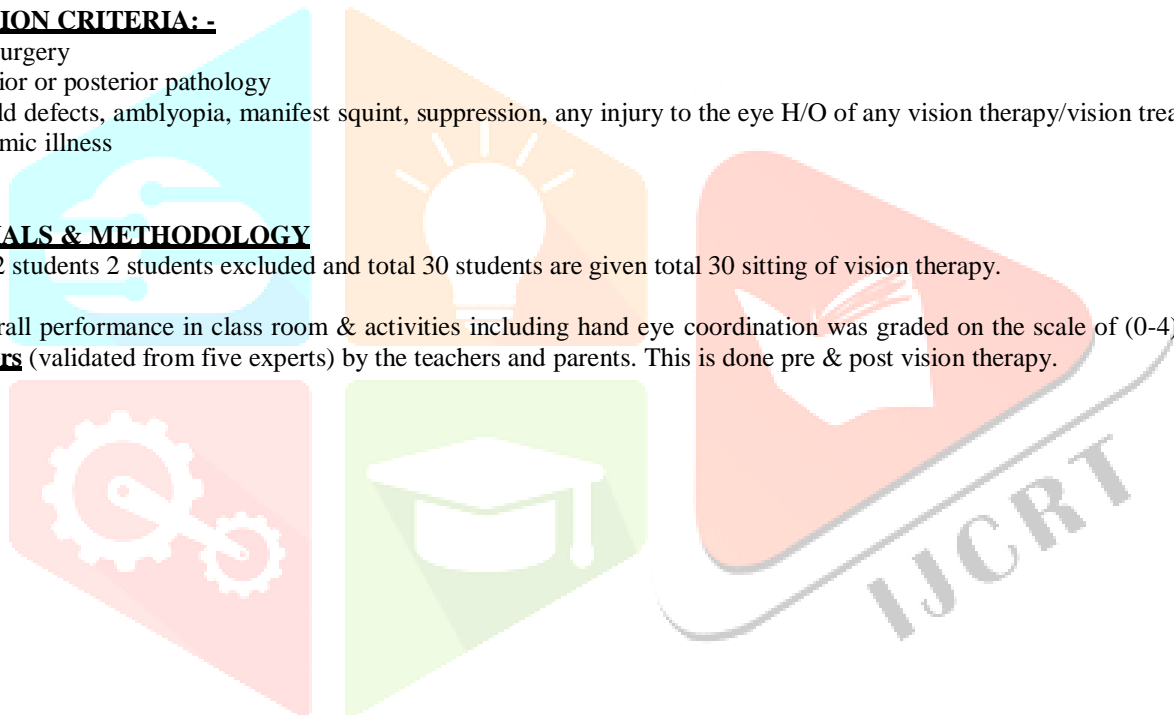H/O any surgery

Any anterior or posterior pathology

Visual field defects, amblyopia, manifest squint, suppression, any injury to the eye H/O of any vision therapy/vision treatment

Any systemic illness

MATERIALS & METHODOLOGY

Among 32 students 2 students excluded and total 30 students are given total 30 sitting of vision therapy.

Their overall performance in class room & activities including hand eye coordination was graded on the scale of (0-4) with the help of **questioners** (validated from five experts) by the teachers and parents. This is done pre & post vision therapy.

Number of patients from different age group

Age group	Number of patients	Percentage (%)
≤ 10	8	26.67
11 - 13	13	43.33
14 - 16	6	20.00
17 - 19	2	6.67
≥ 20	1	3.33
Total	30	100.00

With the help of this table we can see that 11-13 years are 43.33% of total patients more than other age group. Second more age group is ≤10 years of age and they are 26.67% of total study. Mean age in this study is (12.57±3.07)
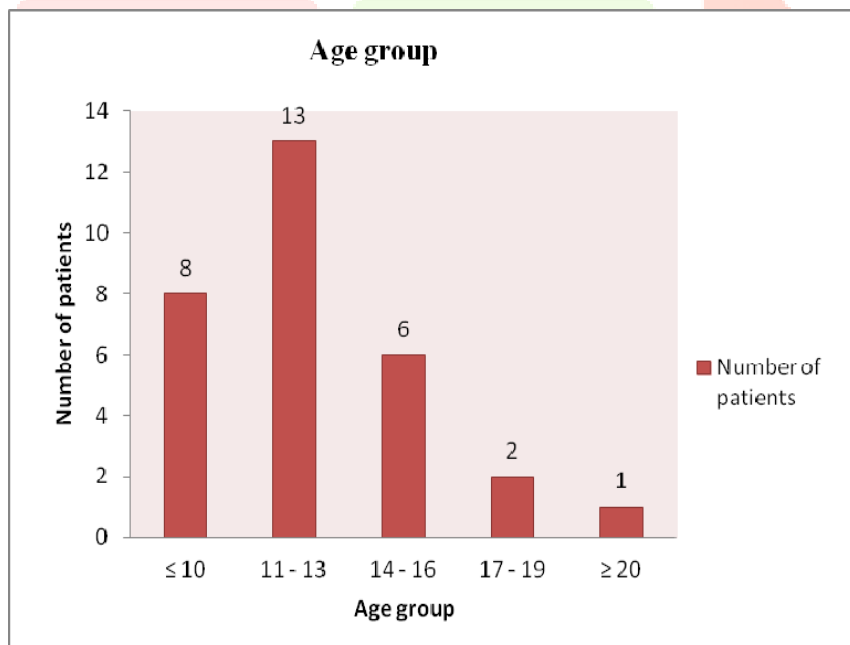

Fig showing number of students between ages of 11-13 years is 13greater then number of students in other age group

<u>Number male & female from total subjects</u>

Gender	Number of patients	Percentage (%)
Male	22	73.33
Female	8	26.67
Total	30	100.00

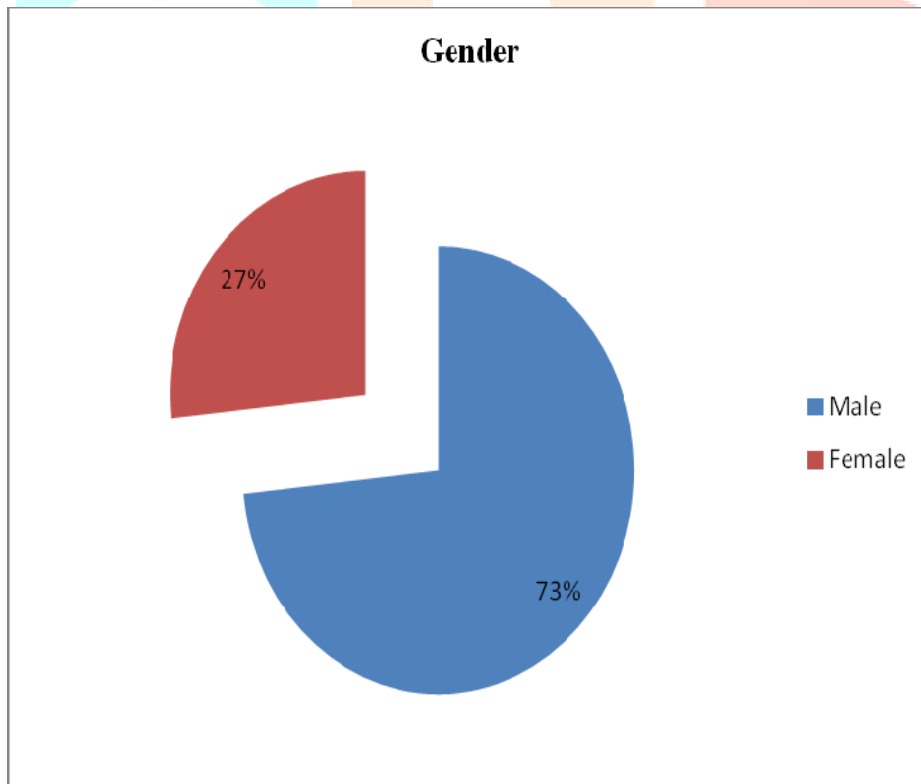**Among 30 studets successfully finish 30 sitting 73% are male and 26.67% are female**

Diagram showing number of male students & female students in this study

visual acuity was recorded with and without correction by using Snellen's visual acuity chart for distance(6meter)& reduced Snellen's acuity chart(40cm) (Marathi or English depending upon the students language preference) under normal room illumination

MEASURMENT OF READING RATE[14,16,17]
Equipment: -
Two copies of the passage one for the students & one for the examiner Stopwatch
Pencil/pen
METHOD: -
Stopwatch was started when the students begins the 1st word of the passage (not title)
(If he/she has trouble struggling for more than 3 to 5sec the examiner will say the word so he or she can keep reading)
After one-minute student was asked to stop & circle last word read
(During reading, resist the urge to correct mistakes that do not holdup the student's time. Mistakes &self-correction will be counted in the score. If the students have extreme difficulty, stop the test. Reassure the students that she or he will re do the assessment after further reading practice)
Errors include: -Skipped words Mispronounced words
Words substitutions, including incorrect forms of word Words in the wrong order
Struggling that lasts for 3 to 5 seconds or more
Not considered as error: -
Added words
Varying pronunciation due to accent or speech impediment Repetitions in which wording is correct
If student's self corrects or mistake, the word is scored as correct.

Fig1-students reading from own level chapters

E.g. Total words read in one minute-70 Errors: -5
Net words read in one minute-(70-5) =65/1minute Result: -65
Rank of reading rate[16,17]
Reading rate for learning -100-200 WPM Reading rate for comprehension-200-400 WPM **Reading rate for deferent grade in school**[14,15] 1st grade-53WPM
2nd grade-89 WPM 3rd grade-107WPM 4th grade-123WPM 5th grade-139WPM 6th grade-150WPM 7th grade-150WPM 8th grade-151WPM
Measurements of different visual skills[10,12,13]
Measurement of near point of convergence: -the near point of convergence (NPC) is the closest points at which an object can be seen single during bi-foveal vision. In other words, it is the point at which the two foveal lines of sight intersect when maximum convergence is exerted.

Procedure

●   A dot or a vertical line may be used as a target.

●   It advanced towards the patient at, or slightly below the eye level, until the patient had converged maximally and could not sustain single bi-foveal fixation as the target was brought closer.

●   At the break point the subject non dominant eye would diverge (objective test) and patient might appreciate diplopia (subjective test)

●   Here subjective test was followed most of the cases as children response was varied and not reliable all the time and same test is repeated for three times for the most accurate result. Which eye diverge first is also noted.

●   The distance from the canthus to the point was read on the rule and NPC was recorded in centimeter.

Ranking of near point of convergence[13]
Adequate: -break point: -7-8 CMS, recovery: -10-11cms **Weak**: -Break point: -9-15cms, recovery: -12-18 cm **Very weak**: -Break point>15cms, recovery point>18 cm

Measurement of fusional vergence at distance &near: -
The alignment of the eye is maintained by motor fusion. The reflex is driven by retinal image disparity. in the normal state retinal image disparity produces diplopia. Motor fusion then triggers a vergence response to align the images of the object of regard on the two foveas. Visual objects brought closer to the observer produce temporal disparity& elicit convergence. Divergence is triggered when visual objects moves farther away and produces nasal disparity. For clinical purpose testing of fusional vergence is performed to assess the power & stability of motor fusion and patient's capacity to compensate for underlying heterophorias.

Fusional vergence at distance: -

● Patient instructed to view 6/6 letters on Snellen's distance visual acuity chart if patient had correction then patient have to wear his/her correction.

● patient asked to try to keep look at the letters at 6 meter and put prism bar **BI** and **BO** for and report if there was any blurring of letters.

● The first sustain blur exceeding 2 seconds was recorded

● Prism of increased base power put in front of the eyes and first sustained diplopia recorded (exceed 5second)

● After the end point of sustained diplopia is reached, reduce the prismatic demand until sustained singleness is reported and recorded as recovery point. In case of distance fusional vergence blur is not usually reported by the observer.

Ranking for fusional vergence at distance[13] For BI (prism diopter)

Very strong-break-8, recovery-6 **Strong**-break-7, recovery-5 **Adequate**-break-6, recovery-4 **Week**-break-5, recovery-3

Very weak-break-4, recovery-2

For BO (prism diopter)

Very strong-break->24recovery->15 **Strong-**break-(21-24), recovery-(12-15) **Adequate-**break-6, recovery-4

Weak-break-5, recovery-3 **Very weak-**break-4, recovery-2 **Fusional vergence at near: -**

● The patient asked to look at the N6 letter on the reduced Snellen's acuity chart at 40 cm working distance with normal room illumination.

● Patient instructed to try to keep look at the letters and report any blurring while putting the prism bar in front of one eye. We increased the base of the prism and the first sustained blur exceeding 2 second was recorded.

● Patient asked to report when the target become double while increasing the base of the prism. The first sustained diplopia was recorded. The amount of diplopia sustained more than 5 second recorded as break.

● After end point when sustained diplopia was reached, the prismatic demand reduced until sustained singleness (but not necessary clearness) was reported.

a good instruction to then patient- **tell me when the double image is again joined into one' the end point is recorded for the recovery value**.

Ranking for fusional vergence at near[13]**: - For BI (prism diopter)**

Very strong-blur->18, break->26, recovery>18

Strong-blur-(14-18), break-(22-26), recovery-(13-18) **Adequate-**blur-(12-13), break (20-21), recovery-(11-13) **Weak-**blur-11, break-19, recovery-10

Very weak-blur-<11, break-<19, recovery-<10

For BO (prism diopter)

Very strong-blur->23, break->28, recovery->18 **Strong-**blur-(18-23), break-(22-28), recovery-(13-18) **Adequate-**blur-(15-17), break-(19-21), recovery-(8-11) **Weak-**blur-14, break-18, recovery-7

Very weak-blur-<14, break-<14, recovery

EYE HAND CO ORDINATION-

Coordinate control of eye movement with hand movement, and the processing of visual input to guide reaching & as grasping along with the use of the hand to guide the eyes. It has been studied in activities as diverse as tea making, the movement of wooden blocks, poor hand writing, sporting performance, video games. it is a way of performing everyday task & in its absence most people would be unable to carry-out simple daily living work like, picking up books from table. Therapy procedure started with easy level then medium & then hard levels. It is an important visual skill & here we measure with the help of questionnaires filled up by patient's teachers and parents.

SCCO SYSTEM: -A quick and simple routine used at southern California College of Optometry (SCCO) for testing horizontal saccadic eye movements is as follows-

A target with a letter printed on it that is approximately equivalent to 20/80(6/24) acuity demand is placed on the right. A similar target is placed on the left. the targets are separated approximately 25 cm and held at a distance of 40 cm from the patient. The patient is asked to move his eyes alternately to each target approximately ten times. The practitioner should look for inaccuracies i.e., either undershooting or overshooting. Scoring the results of observation is on 4+ scale basis as follows[13]-

4+ eye movements are accurate 3+ indicates some undershooting
2+ gross undershooting or any overshooting
1+ inability to do task or child moves his or her head while reading

Fig 2- students with SCCO system used both for testing and therapy

Measurement of accommodative facility was done with the help of flipper (±2.00Dsph lens)

Equipment: -flipper (±2.00), near HC/any reading material from student's class

Procedure: -. The lens flipper was directly in front of the patient's eye (at the spectacle plane or immediately in front of it if the patient is wearing spectacle) binocular testing procedure was done following the monocular procedure. To begin, the minus lens side of the flipper is placed before the patient's eyes. The patient instructed to attend the printed material with the open eye viewing through the minus lens. If print gets blurred, patient was asked to inform when it again became clear. As soon as the print is clear, lens flipped to the plus side & patient asked whether it became blur or clear, if blur patient asked to informed when it became clear,
Each two flips of the lenses (one flip of minus and one flip from the plus) equals 1 cycle. The number of cycles performed in a specific time period (usually 1 minute-i.e., c.p.m)
Ranking of accommodative facility (+2.00Dsph lens)[13]**Adequate (RE/LE)**: -10-13cpm, **(BE)**: -6-7cpm**Weak (RE/LE)**: -6-9cpm, **(BE)**:-4-5cpm**Veryweak(RE/LE):-<6,(BE):-<4cpm**

THERAPY PROCEDURE [10,12,13,31]: -Therapy includes 30 sittings of in-office and home vision therapy. each therapy took 45 minutes to 1 hour in clinic and in school. For home vision therapy all 30 students are provided home vision therapy kits. Which containing

Home vision therapy

Brock string Cat card Eccentric circle

Alphabet pencil (Marathi and English) HART chart (Marathi and English) Pencil (pushup)

IN OFFICE THERAPY: -

Brock string

Prism bar RAF ruler

Flippers($\pm$2.00Dsph) Marsden ball

Video games SCCO system

Seesaw/balance board with HART chart

When conducting vigorous vision therapy at clinical set up we have to give some time for relaxation of eye muscle, otherwise after some time they will lose the concentration. All kind of vision therapy at a time can make the vision therapy sitting very monotonous. for that reason, designing the total vision therapy sitting is very important, like in between two vision therapy tracking games, catching the ball, video game incorporated to make the therapy more interesting. And for home vision therapy all drawing, dot to dot games, video game given and parents are told to constantly monitor the child at home while doing the vision therapy.

BROCK STRING: -

It based on the **principle of physiological diplopia**.

Through Brock string 6 types of therapy were given. initially each type of therapy was done once. As they became familiar each type repeated for 4-5 times. After each type of therapy patients took rest for 1-2minutes

One end of the string hold by the therapist and another end held between patient's thumb and forefinger close to his or her nose. Patients and therapist should be at the same level.

Procedure 1: recognition of physiological diplopia

A bead is sided into a position approximately 15 cm away from the patient's eyes. The patient was instructed to converge his or her eyes to look at the bead. The bead should be seen as one, and the string should look as two. If patient can perform this procedure accurately that means patients **did not have suppression. So, we can proceed to the next step.**

Procedure 2: jumps, two beads at near, and introduction of fixation accuracy

When patient was able to perform the single-bead procedure without difficulty, a second bead was slide forward on the string; the beads were placed approximately 15 and 25 cm from the patient. The patient was instructed to converge his or her eyes to fixate on the closer bead and note how many images of the distant bead are noticed. the distant bead should be doubled. If patient was able to achieve this perception, he or she instructed to change fixation to the distance beads. The distance beads should be seen as one, while near bead should be seen as doubled.

When correct response is perceived (accurate fixation and no suppression), the patient was instructed to shift his or her gaze back and forth between the beads. Our goal is to **Obtaining the PD response as soon and accurately as possible**. When the procedure performed with ease, the near bead may be moved closer and the procedure repeated.

Procedure 3: jumps, three beads at near

A third bead was moved forward on the string. the beads were separated by an approximately equal distance(10cm,25cm,40cm). the patient was instructed to shift his or her gaze from one bead to the other while maintaining the correct PD response. The therapist randomly called out the color of the beads to be fixated. Fixation should be alternate among the three beads. **Speed and accuracy should monitor**.

Procedure 4: jumps, far to near

The far bead was positioned toward the distal end of the string. the patient was instructed to change fixation alternately from the distant bead to one of the near beads. Once again, when a near bead was fixated, the distance bead should be appearing to be doubled in the background. Likewise, when the distance bead was fixated, the beads in the foreground should be appearing to be doubled. The position of the near beads may be changed.

Procedure 5: jumps, three beads (near, intermediate, far)

Three beads were placed the goal of performing the exercise quickly and accurately and easily. On the string, one at a close distance, one at an intermediate distance and another at a far distance (0.3meter 1st bead from patients, 1meter 2nd bead, and 2.4-meter 3rd bead).as with the procedure using three beads at near, the patient was instructed to randomly alternate fixation among the beads. The goal was to **attain accurate fixation quickly with consistent recognition of PD. Speed and accuracy of fixation are emphasized.**

Procedure 6: push up: -
Two beads were moved forward on the string, one at 25 cm and other at 40cm .The patient was instructed to fixate at the front bead and to obtain the correct response (one of the front bead two of the back bead).the front bead is slowly pushed closer to the patient's eyes, as the patient was instructed to maintain singleness of the front bead while the back bead appears double. Moving the bead was discontinued when the front bead breaks into two or if the back bead becomes one. Then the front bead pushed slowly away from the patient's eyes before doubling.

Fig3-students doing exercise on brock string with 3 beads

.

HART chart: -HC consist of two cardboard charts, each containing a block of 100 (10 rows of 10 letters each) black letters printed on a white background; it contains a large and smaller version of letters. The larger Hart chart is used for distance fixation and the smaller HART chat for near fixation.
HART chat therapy uses a change in fixation distance as the stimulus to alter accommodation. Alternating fixation between near and far HART charts is used for facility therapy.
Procedure: -The distance HART chart was placed at the eye level on a wall opposite the patient. The patient asked to hold the small HART chat at the arm's length. The patient was instructed to read the letters on the small HC while slowly moving it towards his or her open eye. When the letters begin to blur, the patient instructed to stop moving the chart and to make these blurred letters clear. When the letters become clear, the patient asked to resume moving the chart closer until blur is noted again. once more, the patient instructed to cease moving the chart and to make the letters clear. The patient asked to continue this manner until he or she can no longer make the letters clear. At this point, the patient was instructed to move the small HC about 1 to 2 cm away and to hold it steady in this location.
Next patient was instructed to look at the distance HC and to make the letter clear as quickly as possible. When the distance HC is clear, the patient looks back at the near HC is an attempt to clear the letters on this card rapidly. Fixation was alternated between the distance and near HCs .The patient attempts to clear the letters as quickly as possible with each change in fixation. **The goal is to clear the letters in 1 to 2 seconds**. When reliability of the patient's response is suspect, the patient is asked to call letters aloud. Various patterns of letter reading, such as two letters at a time from each chart, may be used for Varity. The procedure is repeated for the other eye, with a goal of equality of the two eye's performance.

Flipper (±2.00Dsph)
Equipment: -plus and minus lens, near HC as near reading material

Method: -flippers used to produce rapid changes in the accommodative demand. The lens flipper was directly in front of the patient's eye (at the spectacle plane or immediately in front of it if the patient is wearing spectacle) binocular therapy was done following the monocular therapy. To begin, the minus lens side of the flipper was placed before the patient's eyes. The patient instructed to attend the printed material with the open eye viewing through the minus lens. If print gets blurred, patient was asked to make it clear. As soon as the print cleared, patient was instructed to make the print clear again. The patient continued to alternately turn the lens flipper as soon as the prints become clear. Clearing the print within 1 to 2 seconds without fatigue or discomfort is the goal. The patient should be encouraged to notice the felling or effort needed to clear each side of theflipper.
Each two flips of the lenses (one flip of minus and one flip from the plus) equals 1 cycle. **The goal is for the patient to increase his or her speed in clearing the print thereby increasing the number of cycles performed in a specific time period (usually 1 minute-i.e, cpm)**

Prism therapy with prism bar: -

Fig 3- Pt doing lens flipper exercise

Equipment: - BI and BO prism bar (up to 40 Prism Diopter), distance target, near target

Method: - Binocularly prisms were used to create vengeance demands. Inverse prisms were used to increase the demand to compensating fusional vergence.

A small amount of prism was brought from the side of the patient's head and placed directly in front of the patient's one eye. The base of the prism should be held with the edge of the base exactly vertical. the target (at 6meter for distance and 40 cm for near) may appear to double with the introduction of the prism. If this happen, then patient was instructed to concentrate and fuse the target into one as quickly as possible and prism of increasing value put in front of the patient's eye. **This procedure will continue till patient can fuse the target. The goal is to increase the smoothness and speed of the fusion, so that eventually, the response is automatic with little or no diplopia recognition.**

Fig 4- Pt doing exercise horizontal prism bar to increase fusional vergence range

Eccentric card

Equipment: - one card containing two big circle and two small circle in big circle, pen or pencil

Procedure: - Patient asked to hold the card in one hand at the habitual working distance and with the other hand holds a sharpened pencil point centered between the two circles. Then patient asked to fixate the pencil point and then begins to move it slowly towards his or her eyes, concentrating on keeping the pencil point single, clear, and centered between the set of the circles in the background.

Patient initially fixated the pencil tip centered between the two circles and positioned in front of the card.

As the patient brought the pencil tip closer to his or her eyes, the circle appear to double, so that a total four circles are seen.

When the pencil tip reached a particular position, the center of two circles fuse into one, so that a total three circle is perceived.

The patient told to concentrate on keeping the pencil point single and the circles in the background triple.
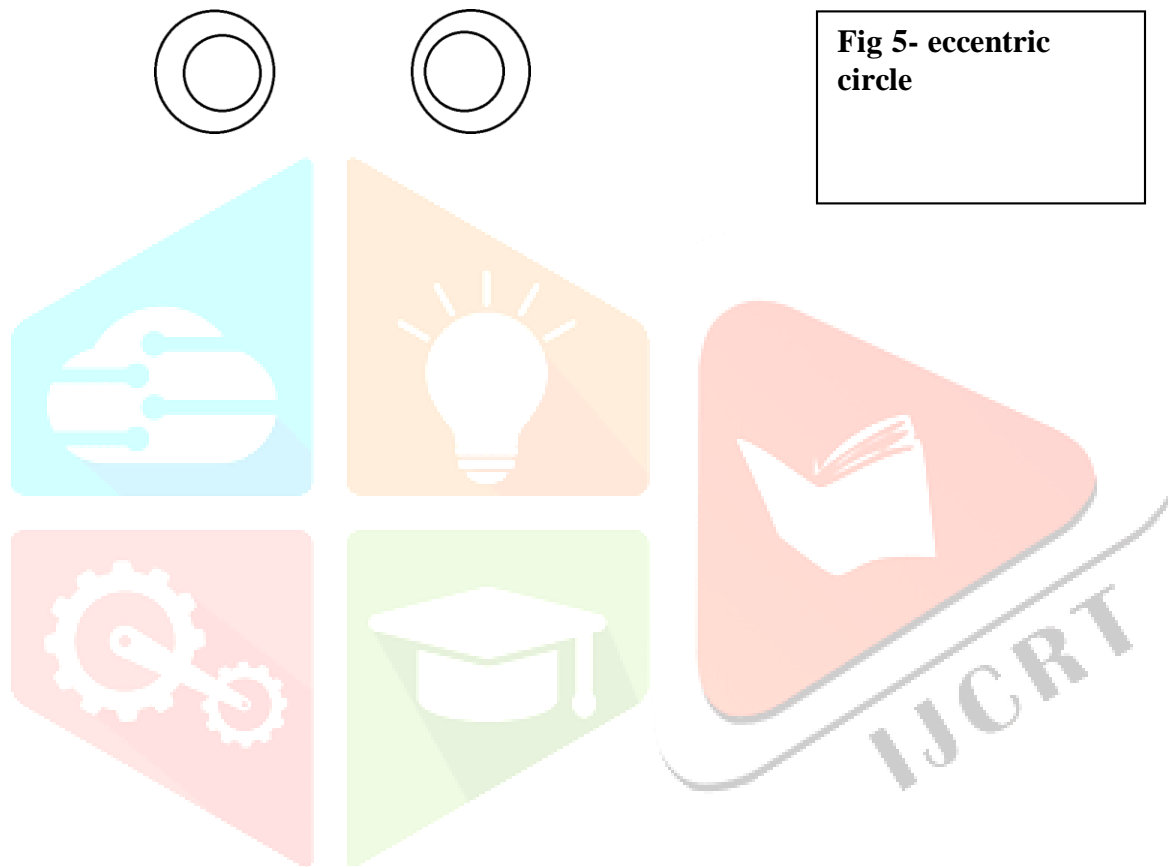
Fig 5- eccentric circle

RAF ruler

Equipment: -RAF ruler (royal air force)

Procedure: -use to increase physiological diplopia, gross convergence, or fusional vergence ability.

Procedure 1: basic push up to increase gross convergence ability: -In RAF ruler there is box containing different type of near target (letters, sentences, black circle with one line),one side of the rod there is a scale which showing the distance between target and the end point of the ruler. Patient was directed to look at the circle/dot while the examiner slowly drags the box towards patient's eye as the box brought closer, the patient instructed to 'pull your eyes inward' and to feel the movement of the eyes and make the circle/dot single if it became double. **Our goal is to make the patient see single circle till the tip of the nose**

Procedure 2: tromboning:-Once the patient was able to move the dot/circle to tip of the nose (or very close to it) without diplopia ,tromboning was initiated .Patient was instructed to bring the box as close as possible before it doubles and then to slowly and smoothly move the box away until it is at arm's length. The patient was directed to concentrate on keeping the circle/dot single.
Here the goal is to increase **smoothness and speed**

Pencil push up: -pencil push up is a popular home vision therapy for its low cost and easy availability. Though it's easily available it is very useful exercise at home specially for convergence insufficiency.
Material: - sharpened pencil or pen
General instruction: -the patient holds a sharpened pencil vertically (tip pointed upward) at eye level and at arm's length.
Procedure 1: Basic pencil push-ups:-the patient asked to slowly and smoothly move the pencil closer to his her nose. As the pencil brought closer, the patient was instructed to "pull eyes inward" and to "feel the movement of the eye". The patient directed to continue moving thepencil toward the nose even after it becomes blurred and is to concentrate on keeping pencil single. Emphasis was placed on keeping the pencil single. the patient was instructed stop moving the pencil when diplopia of the pencil is recognized and to note the distance where the diplopia occurred. The patient was then directed to start the procedure over again, in an attempt to bring the pencil even closer before it doubles. The procedure was repeated, and the patient tried to keep the pencil single for longer time periods on each attempt. The patient's goal is **to be able to maintain singleness of pencil from arm's length to the tip of his or her nose**.
Procedure 2: Tromboningonce the patient was able to move the pencil to the tip of the nose (or very close to it) without diplopia, thromboning was initiated. The patient was instructed to bring the pencil as close as possible before it gets doubles and then to slowly and smoothly move the pencil away until it is at arm's length. The patient asked to concentrate on keeping the pencil single and background object doubled at all times as pencil is gradually moved towards and away from the eye. It's mainly **increases smoothness and speed.**
Procedure 3: Sustained converge the patient asked to start the procedure as before. When the patient reached the point where it becomes difficult to keep the pencil single, he or she instructed to hold the pencil at this spot while maintaining a single pencil tip. Single vision was held for 5 seconds, and the procedure was repeated. The amount of time that that convergence is sustained was increased on successive attempts. The feeling of convergence was emphasized. **The patient should be able to steadily maintain single vision for 30 second time period.**

Fig 6- students with RAF ruler used as to measure NPC as well as exercise for NPC

Marsden ball: -Bat and marsden ball used to increase the hand eye coordination. Marsden ball without bat is used to train smooth pursuit and saccadic movement.

Equipment: -A plastic medium size ball which contain 6/24 to 6/12 size number (Marathi & English), letters, picture (for small children), a rope to hang the ball, we can also use different color

Procedure 1 :-for hand eye coordination:-while the dominant eye was occluded ,one task was for the patient to hold the stick with two hands and hit the ball with identical segments on the left side and on the right. And then binocularly the patient attempts to establish a regular pattern for **at least 20 hits**.

Procedure 2: for saccadic and smooth pursuit: -swinging the ball with letters drawn on it in a fore and circular pattern provides and as well as a pursuit tracking stimulus**. The goal in this case is to keep the letters clear at all times as the arc of the excursion is increased**. Swinging the ball in the horizontal plane with the patient standing or sitting (plane of the movement of the ball should be at the same level) perpendicular to the swing gives a periodic, predictable, smooth pursuit stimulus for the patient tofollow.

Fig 7- Pt doing exercise in marsden ball for pursuit and saccades and hand eye co ordination

Cat card exercise: -

Equipment needed: -one card containing two similar but incomplete picture (example: cat having ear another cat not having ear), pencil or pen

Procedure: -Patient asked to hold the card in one hand at the habitual working distance (usually at 40 cm) and with the other hand holds a sharpened pencil/pen point centered between the two circles. The patient asked to fixates the pencil point and then begins to move it slowly towards his or her eyes, concentrating on keeping the pencil point single, clear, and centered between the set of the circles in the background.

Patient initially asked to fixate the pencil tip centered between the two circles and positioned in front of thecard.

As the patient brought the pencil tip closer to his or her eyes, the cat appear to double, so that a total four cat isseen.

When the pencil tip reached a particular position, the center of two circles fuse into one, so that a total three cat isperceived.
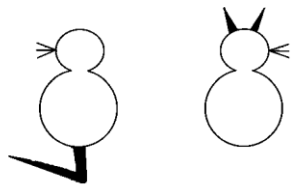
Fig 8- cat card exercise

<u>Seesaw exercise for body eye coordination: -</u>we can improve body eye coordination with the help vision therapy exercise.

<u>Equipment: -</u>Balance board, distance HC

<u>Procedure: -</u>The distance (1st start with closer distance) HC hanged on to the wall and place the balance board on the floor. Patient was asked to stand on the balance board (without any support and both the hands straight both side) at the 1st day of sitting patient might find difficulty to even stand on the balance board but we have to encourage the patient to do that. Then we asked the patient to move the balance board and read the distance HC simultaneously. At first our goal is **to read HC correctly while doing the balancing.** Our second goal is to **increase the speed of reading and balancing.**

Fig 9 balance board

<u>Video game:</u> -video game included to increases to eye hand coordination and also to increase saccadic and pursuit movement. children are very much interested to play video games so we can easily attract towards vision therapy program easily. Here we included 3 types of video game for 15 minutes after finishing other sitting like table tennis, air flashing, and eggs.

Equipment: - computer

Procedure: -These computer video game star with a icon 'play' or start 'new game' and it also consist level like **easy, medium, hard** and also having scoring system. Patient should play the game under the supervision of the examiner or parents. First start with easy one and record the number of missing games. if patient succeeded for the easy level then examiner will plan for the medium level and then hard level. The total score and patient can actually quantify the improvement at every sitting.

<u>SCCO system/alphabet pencil:</u> -in office and for home vision therapy. The main role of the SCCO system is to increase saccadic movement of the eye.

<u>Equipment</u>: -SCCO system, two pencil of same size, 25 letters written on one column of 6/24 size (Marathi and English)

<u>Procedure: -</u>
SCCO-The patient asked to hold the SCCO system at the 40 cm distance head should be straight position. Patient instructed to read the same size letters from both side of stand simultaneously. Patient was monitored if patient read accurately without missing out the words and any head movement if noticed then it documented. If any head movement and missing out of letters of any side is noticed while doing the test the procedure then our primary goal will be to **make the patient readout without missing the letters and decrease the head movement**. Then our next goal will be read out the letters accurately.
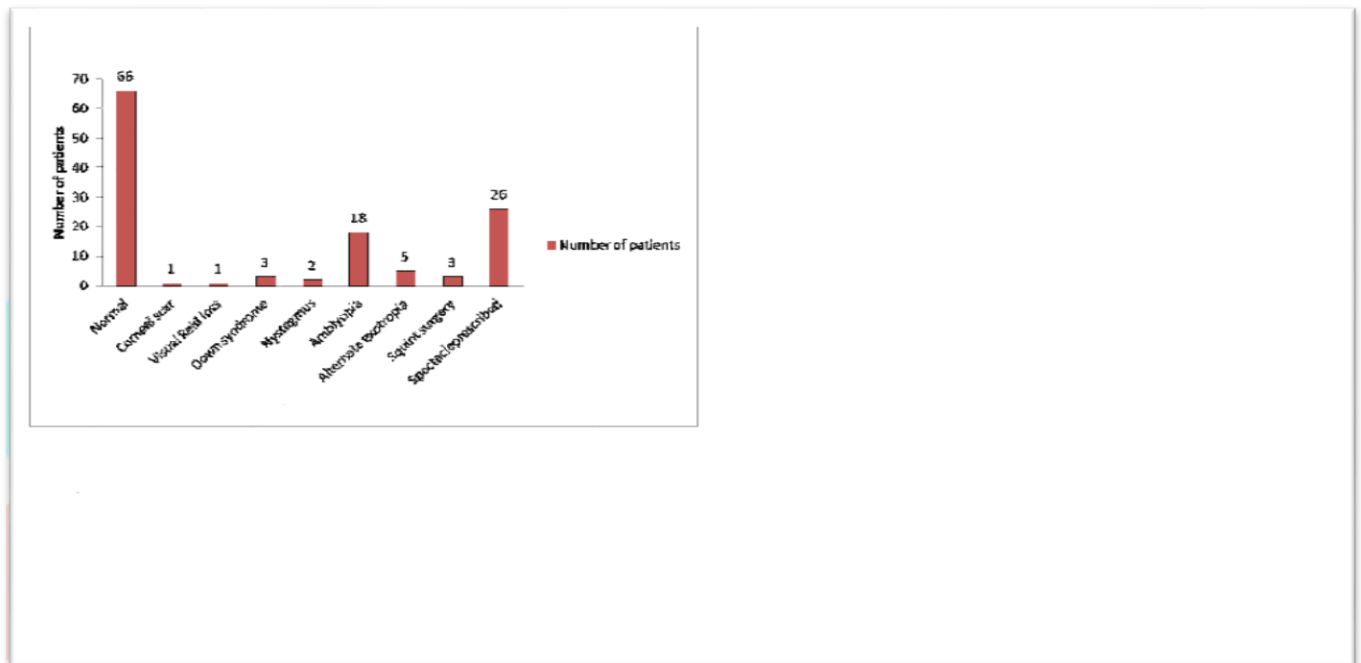**<u>Alphabet pencil</u>**: -same method followed while doing this exercise its main popularity is its low cost, easy availability so perform as home vision therapy. For young uncooperative children we can use colorful pencil (has to be two different color. we have to hold two pencils at 25 cm distance from one another and both should be at the same level. Then patient was instructed to read out the letters, numbers, or simply ask the patient to look at the different color pencil when ask by the examiner.

SCCO system/alphabet pencil: -in office and for home vision therapy. The main role of the SCCO system is to increase saccadic movement without missing out the words and any head movement if noticed then it documented. If any head movement and missing out of letters of any side is noticed while doing the test the procedure then our primary goal will be to **make the patient readout without missing the letters and decrease the head movement**. Then our next goal will be read out the letters accurately.

Alphabet pencil: -same method followed while doing this exercise its main popularity is its low cost, easy availability so perform as home vision therapy. For young uncooperative children we can use colorful pencil (has to be two different color. we have to hold two pencils at 25 cm distance from one another and both should be at the same level. Then patient was instructed to read out the letters, numbers, or simply ask the patient to look at the different color pencil when ask by the examiner.

Statistical analysis and results

Total 130 students were screened, among 130 students 30 students are selected for the 30 sitting vision therapy program and comparison done for baseline 15th sitting and 30th sitting with the help of **SPSS version 17.0** & two type of test **paired t test** and **wilcoxon sign rank test** **PREVALENCE OF VISUAL PROBLEM AMONG SLOW LEARNERS**
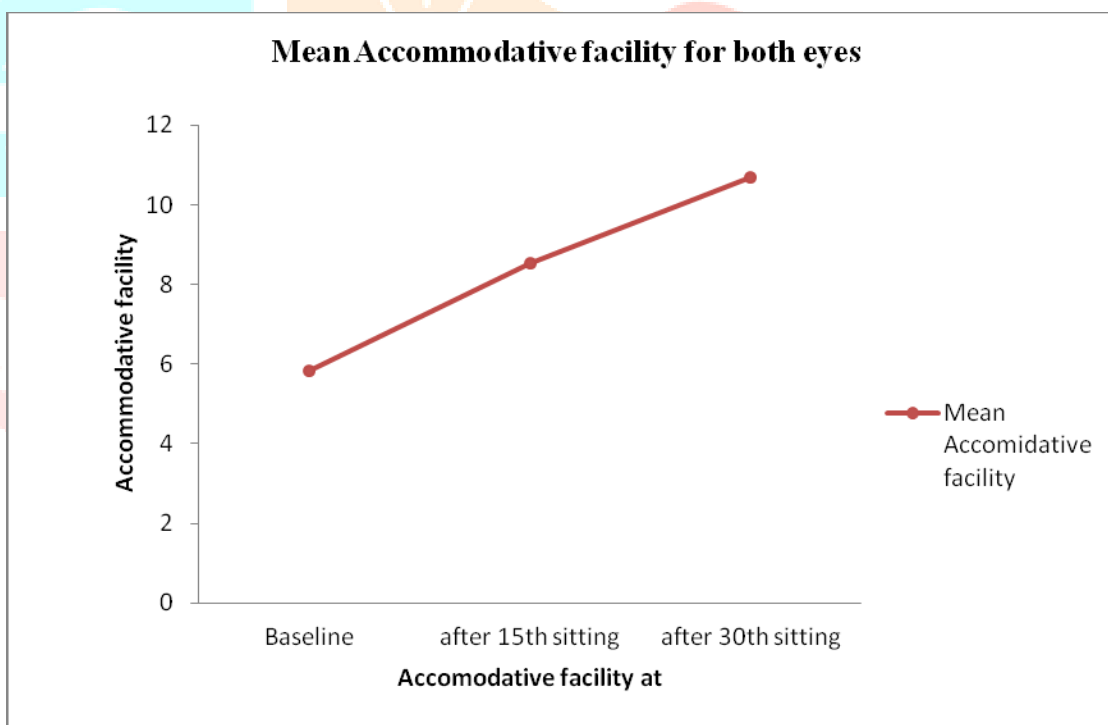

from one hundred and thirty students total, twenty students are prescribed with spectacle and sixty six are normal (no visual problems)

One student had corneal scar (referred for further corneal examination & management).

One student had visual field loss (referred for low vision care),

Two were having nystagmus with amblyopia (referred for further management)

Three were having down syndrome with amblyopia and retinal problem (referred for further retinal examination &management)

Eighteen were having amblyopia (send for further management)

Five were having alternate exotropia (send for detail examination & management)

Three were having prior H/O of surgery (referred for detail examination and management for further improvement)

Optometric intervention was done for total 130 students

Comparison of accommodative facility at baseline and after 15th sitting, at 30th sitting.

Accommodative facility at	Number of patients	Accommodative facility (Mean ± SD)	p-value
Baseline	30	5.83 ± 2.44	
after 15th sitting	30	8.53 ± 1.80	< 0.001
after 30th sitting	30	10.70 ± 2.29	< 0.001

By using paired t-test ($p\text{-value} < 0.05$) therefore there is significant difference between baseline accommodative facility and accommodative facility at 15th sitting, 30th sitting.

Mean Accommodative facility for both eyes

Result shows 46.29% improvement on 15th sitting from baseline & 83.43% improvement on 30th sitting from base line

Comparison of near point for convergence (NPC) for break and recovery at baseline with 15th and 30th sitting: -

1. Break

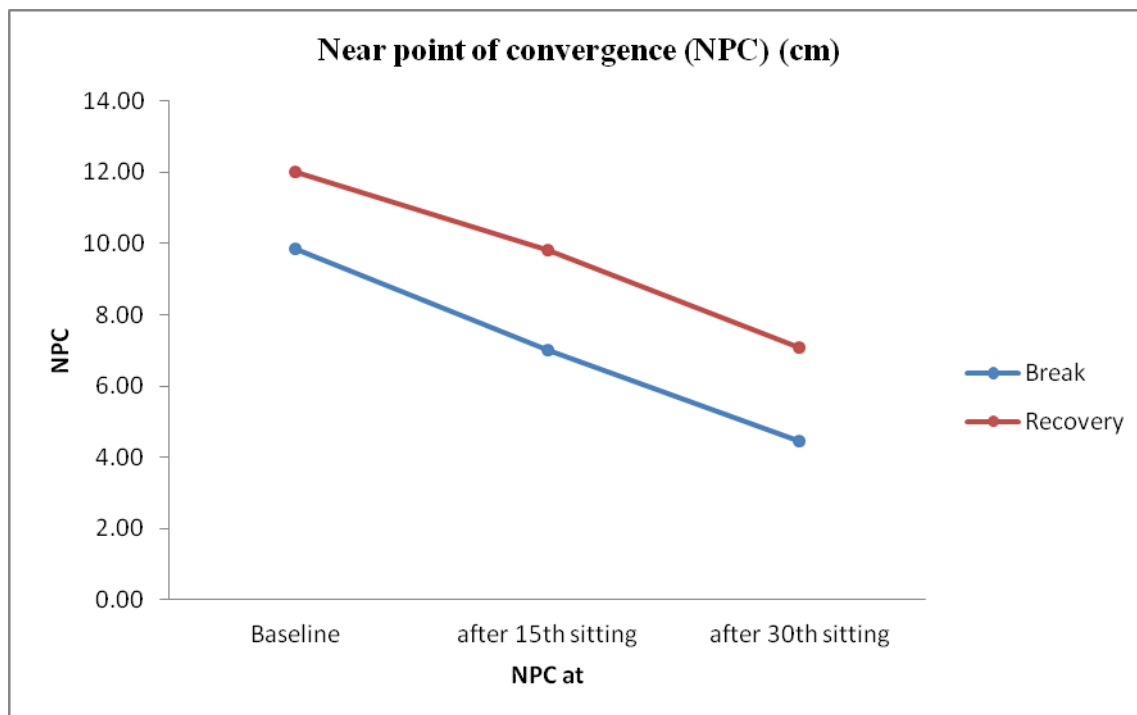| NPC for break	Number of patients	NPC (Mean ± SD)	p-value
Baseline	30	9.87 ± 3.59	
after 15th sitting	30	7.00 ± 2.39	< 0.001
after 30th sitting	30	4.47 ± 0.86	< 0.001

By using paired t-test (p-value < 0.05) therefore there is significant difference between baseline near point for convergence and near point convergence at 15th sitting, 30th sitting

.

2. Recovery

NPC for recovery	Number of patients	NPC (Mean ± SD)	p-value
Baseline	30	12.00 ± 3.02	
after 15th sitting	30	9.80 ± 2.54	< 0.001
after 30th sitting	30	7.07 ± 1.01	< 0.001

By using paired t-test (p-value < 0.05) therefore there is significant difference between baseline near point for convergence and near point convergence at 15th sitting, 30th sitting for recovery.

Comparison of NPC baseline with 15th days &30th days sitting

Result shows

- **29.05% improvement on 15th sitting from base line in break and -54.73% improvements on 30th sitting from base line its negative as near pointdecrease.**

- **-18.33%improvement on 15th sitting from base line in recovery and -41.11% improvement on recovery from baseline to 30thsitting**

Comparison of fusional vergence (FV) for break and recovery at baseline with15th and 30th sitting using base in prism for distance.

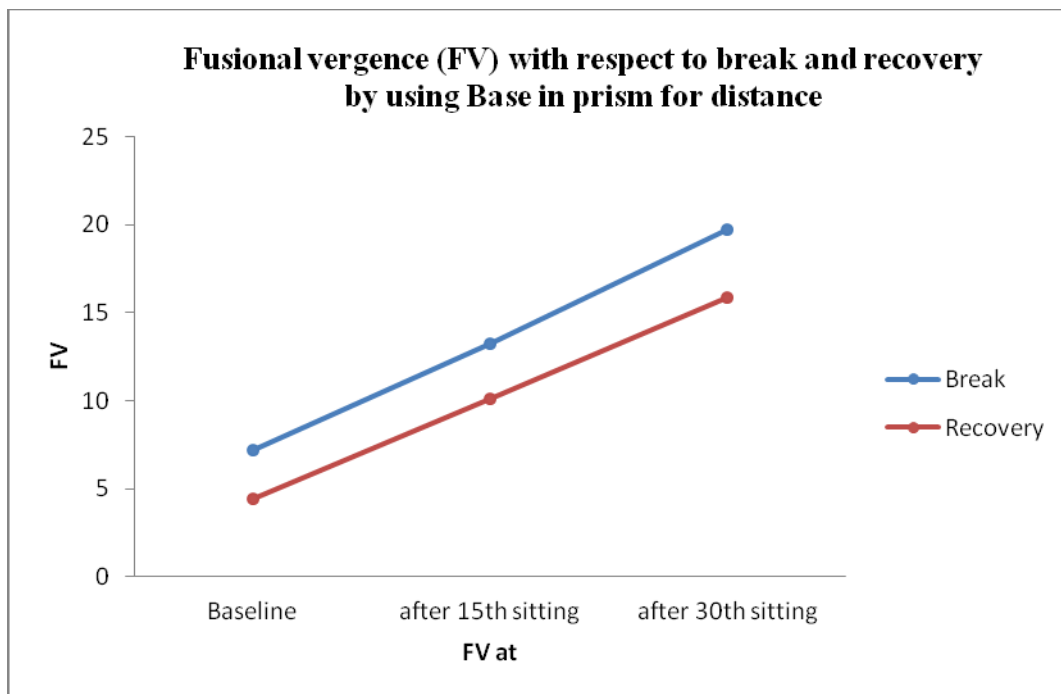### 1. Break

FV for break	Number of patients	FV (Mean ± SD)	p-value
Baseline	30	7.20 ± 2.01	
after 15th sitting	30	13.27 ± 2.13	< 0.001
after 30th sitting	30	19.73 ± 4.14	< 0.001

By using paired t-test(p-value < 0.05) therefore there is significant difference between baseline fusional vergence and fusional vergence at 15th sitting , 30th sitting for break.

2. Recovery

FV for Recovery	Number of patients	FV (Mean ± SD)	p-value
Baseline	30	4.40 ± 2.13	
after 15th sitting	30	10.07 ± 2.07	< 0.001
after 30th sitting	30	15.83 ± 2.90	< 0.001

By using paired t-test (p-value < 0.05) therefore there is significant difference between baseline fusional vergence and fusional vergence at 15th sitting, 30th sitting for recovery.

Fusional vergence (FV) with respect to break and recovery by using Base in prism for distance

Result shows

Fusional vergence at distance with base in prism in break shows 84.26% improvement on 15th sitting from baseline and 174.07%improvement seen on 30th sitting

Fusional vergence at distance with BI prism in break shows 128.79%improvement on 15th sitting from baseline and 259.85% improvement on 30th sitting

4. Comparison of fusional vergence (FV) for break and recovery at baseline with 15th and 30th sitting using base in prism for near.
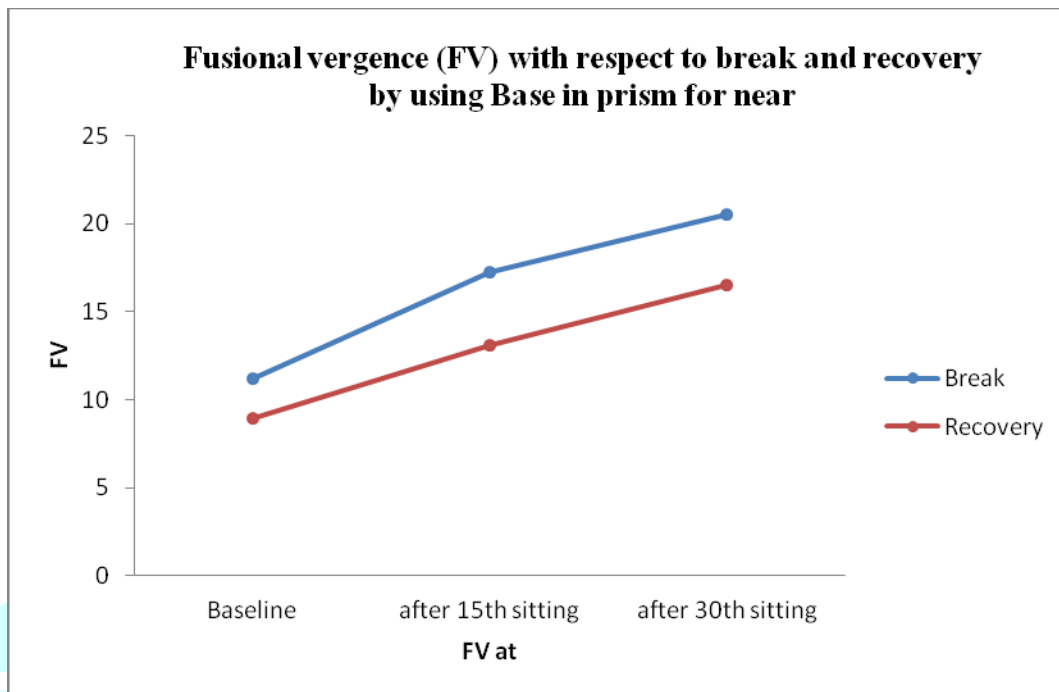
1.Break

FV for break	Number of patients	FV (Mean ± SD)	p-value
Baseline	30	11.20 ± 2.61	
after 15th sitting	30	17.23 ± 2.43	< 0.001
after 30th sitting	30	20.53 ± 4.32	< 0.001

By using paired t-test p-value < 0.05 therefore there is significant difference between baseline fusional vergence and fusional vergence at 15th sitting , 30th sitting for break.

2. Recovery

FV for Recovery	Number of patients	FV (Mean ± SD)	p-value
Baseline	30	8.93 ± 2.45	
after 15th sitting	30	13.07 ± 2.39	< 0.001
after 30th sitting	30	16.50 ± 2.76	< 0.001

By using paired t-test p-value < 0.05 therefore there is significant difference between baseline fusional vergence and fusional vergence at 15th sitting, 30th sitting for recovery.

Result shows

FV at near with BI prism at near break point improved 53.87% on 15th sitting from base line and 83.33% improvement on 30th sitting

Fv at near with BI prism at near recovery point improved 46.27% on 15th sitting from baseline and 84.70% improvement on 30th sitting

5. Comparison of fusional vergence (FV) for break and recovery at baseline with 15th and 30ᵗʰ sitting using base out prism for distance.
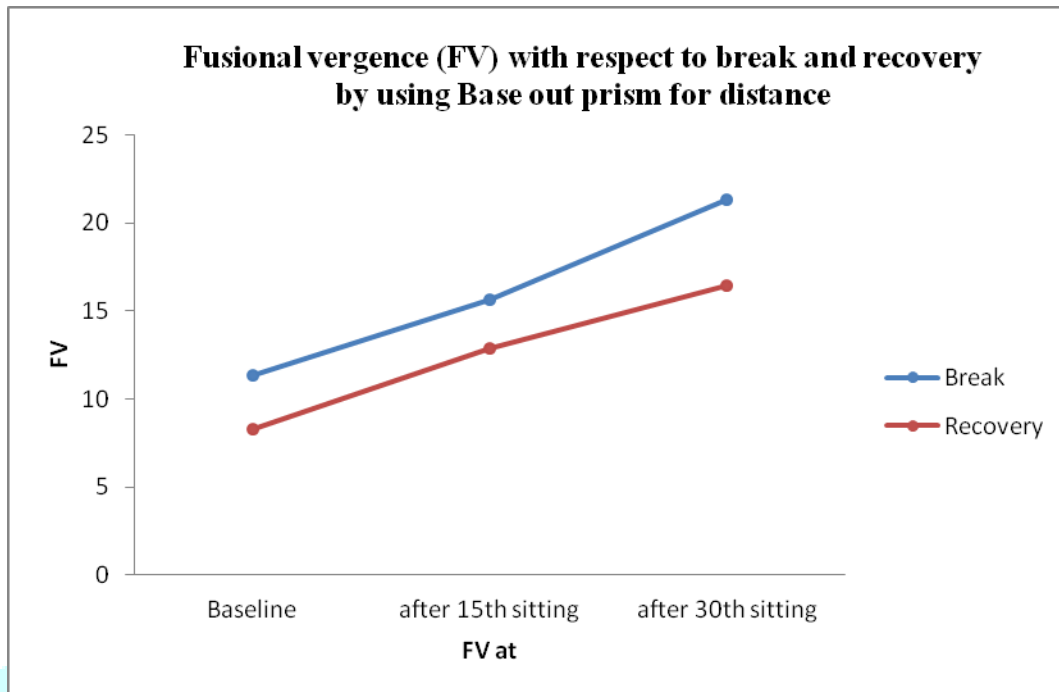
1. Break

FV for break	Number of patients	FV (Mean ± SD)	p-value
Baseline	30	11.33 ± 1.99	
after 15th sitting	30	15.60 ± 2.94	< 0.001
after 30th sitting	30	21.33 ± 4.82	< 0.001

By using paired t-test (p-value < 0.05) therefore there is significant difference between baseline fusional vergence and fusional vergence at 15ᵗʰsitting, 30ᵗʰ sitting for break.

2. Recovery

FV for Recovery	Number of patients	FV (Mean ± SD)	p-value
Baseline	30	8.27 ± 1.87	
after 15th sitting	30	12.87 ± 3.00	< 0.001
after 30th sitting	30	16.47 ± 2.81	< 0.001

By using paired t-test (p-value < 0.05) therefore there is significant difference between baseline fusional vergence and fusional vergence at 15ᵗʰsitting, 30ᵗʰ sitting for recovery

Fusional vergence (FV) with respect to break and recovery by using Base out prism for distance

Result shows

FV at distance with BO prism when measured break point improved 37.65%on 15th sitting from baseline and 88.24% improvement seen on 30th sitting from base line

FV at distance with BO prism when measured recovery point its shown 55.65% improvement on 15th sitting from baseline and shown 99.19% improvement on 30th sitting

6. Comparison of fusional vergence (FV) for break and recovery at baseline with 15th and 30th sitting using base out prism for near
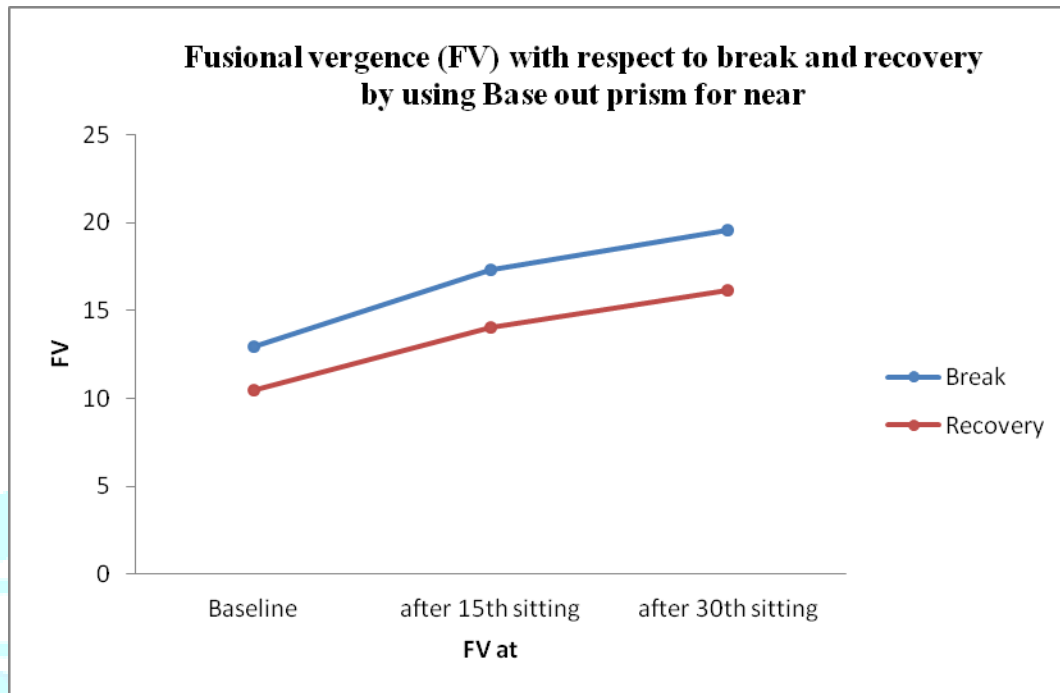
FV for break	Number of patients	FV (Mean ± SD)	p-value
Baseline	30	12.93 ± 2.96	
after 15th sitting	30	17.33 ± 1.92	< 0.001
after 30th sitting	30	19.57 ± 3.40	< 0.001

By using paired t-test (p-value < 0.05) therefore there is significant difference between baseline fusional vergence and fusional vergence at 15th sitting, 30th sitting for break.

1. Recovery

FV for Recovery	Number of patients	FV (Mean ± SD)	p-value
Baseline	30	10.47 ± 2.81	
after 15th sitting	30	14.00 ± 2.35	< 0.001
after 30th sitting	30	16.17 ± 2.73	< 0.001

By using paired t-test(p-value < 0.05)therefore there is significant difference between baseline fusional vergence and fusional vergence at 15th sitting , 30th sitting for recovery.

Fusional vergence (FV) with respect to break and recovery by using Base out prism for near

Result shows

FV at near using BO prism when measured for break point, it shows 34.02% improvement on 15th sitting from base line & 51.29% improvement on 30th sitting from baseline

FV at near using BO prism when measured for recovery point, it shows 33.76% improvement from baseline on 15th sitting and 54.46% improvement 30th sitting from baseline

6. Comparison of reading rate.

1. <u>Total words per minute (TWPM)</u>

TWPM	Number of Patients	TWPM (Mean ± SD)	p-value
Baseline	30	56.27 ± 29.19	
after 15th sitting	30	71.53 ± 32.14	< 0.001
after 30th sitting	30	97.77 ± 36.44	< 0.001

By using paired t-test (p-value < 0.05) therefore there is significant difference between baseline TWPM and TWPM at 15th sitting, 30th sitting.
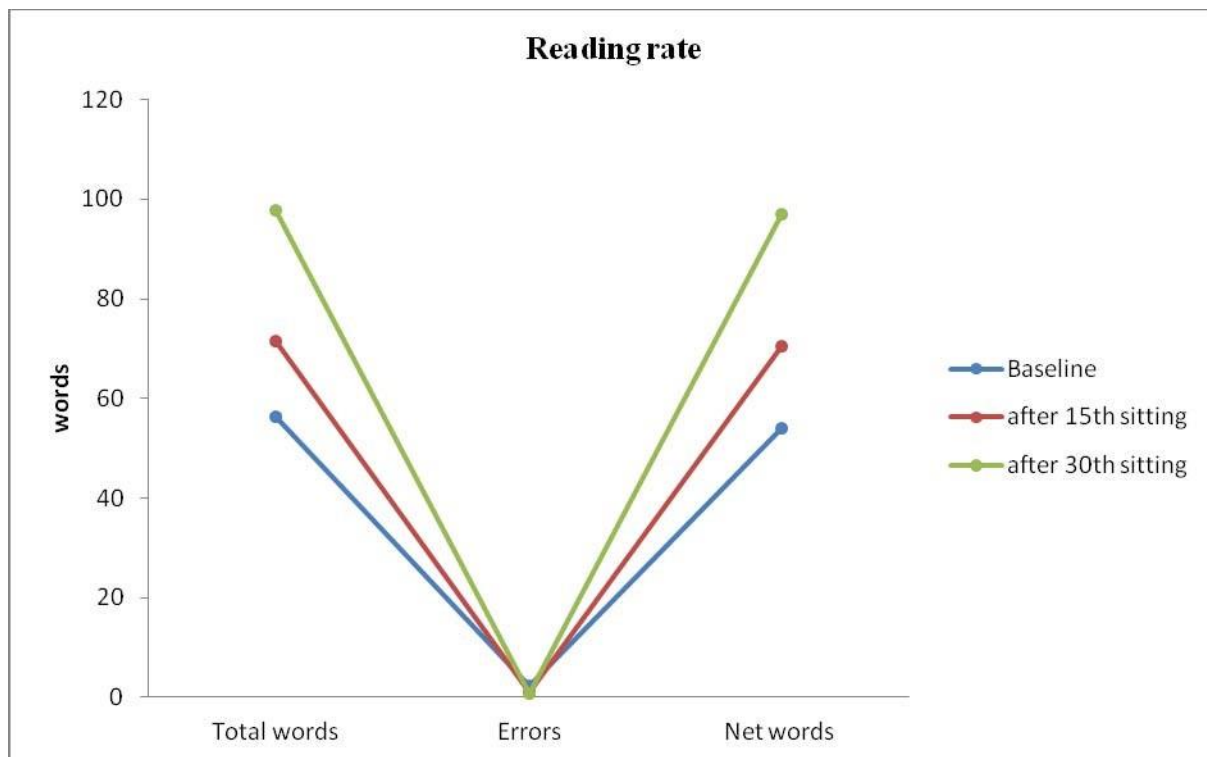
2. <u>Total number of errors per minute</u>

Errors	Number of Patients	Errors (Mean ± SD)	p-value
Baseline	30	2.23 ± 1.91	
after 15th sitting	30	1.00 ± 0.98	< 0.001
after 30th sitting	30	0.83 ± 1.05	< 0.001

By using paired t-test (p-value < 0.05) therefore there is significant difference between baseline errors and errors at 15th sitting, 30th sitting.

3. <u>Net words per minute(NWPM)</u>

NWPM	Number of patients	NWPM (Mean ± SD)	p-value
Baseline	30	54.03 ± 28.59	
after 15th sitting	30	70.23 ± 32.39	< 0.001
after 30th sitting	30	96.97 ± 36.41	< 0.001

By using paired t-test (p-value < 0.05) therefore there is significant difference between baseline NWPM and NWPM at 15th sitting, 30th sitting.

Result shows

when analysis done for reading rate total word per minute improved **27.13% on 15ᵗʰ sitting from base line data and 73.76% improvement seen on 30ᵗʰ sitting.**

Improvement of error also shown (decreased) 55.22% error decreased on 15ᵗʰ sitting and 62.69% error decreased on 30ᵗʰ sitting.

Net word per minute also shown improvement 30.54% improvement shown on 15ᵗʰ sitting from baseline data and 79.46%improvement shown on 30ᵗʰ sitting from baseline

QUESTIONNERIES DATA

Questions	Pre-treatment	Post-treatment	p-value
Q1	4	0	< 0.001
Q2	3	0	< 0.001
Q3	3	0	< 0.001
Q4	2	0	< 0.001
Q5	2	0	< 0.001
Q6	4	0	< 0.001
Q7	2	0	< 0.001
Q8	3	0	< 0.001
Q9	1.5	0	< 0.001
Q10	2	0	< 0.001
Q11	0.5	0	0.001

Result: -total 11 questions are given to the parents and teachers to assess their quality of life, symptoms, hand eye coordination and post vision therapy and post treatment in all questions shows a significant improvement which is also statistically significant. (P-value<0.01)

For question number one **pre vision** therapy 3.3% students **seldom** had the problem of copying from the board, 3.3% **never** had the problem, 40% students had this problem **frequently,** and 53.3% students had this problem **always**. **Post vision** therapy only 3.3% students had this problem **seldom** & 96.7% students improve to **never** have the problem of copying from the board.

For question number two **pre vision** therapy 3.3% students **never** had the problem of avoiding near work,16.7% students **seldom** had this problem,10% students **occasionally** had this problem,50% students **frequently** had this problem & 20% of students **always** had this problem. Post vision therapy 100% students improve to **never** have this problem.

For question number three **pre vision** therapy 16.7% **seldom** had the problem of reading comprehension which is decline over time, 16.7% students had **occasionally**, 34.5% students

frequently & 31.0% students **always** had this problem. **Post vision** therapy 83.3% students never & only 16.7% seldom have this problem.

For question number <u>four</u> **pre vision** therapy 10% students **never** had the problem of inconsistence or poor performance in sports, 23.3% students **seldom** had this problem.26.7% **occasionally**, 13.3% **frequently** & 26.7% students **always** had this problem. Post vision therapy 13.3% **seldom** & 86.7% students improve to **never** have this problem.

For <u>five</u> numbers question **pre vision** therapy 23.3% students **never** had the problem of handling scissors, screwdriver, and calculators 23.3% students **seldom** had the problem, 6.7% **frequently** & 30% students **always** had the problem. **Post vision** therapy 6.7% students **seldom** & 93.3% students improves to **never** had this problem.

For number <u>six</u> question **pre vision therapy** 3.3% of students **never** had the problem of short attention span.6.7% student's **occasionally**, 30% **frequently** & 60% students **always** had this problem. Post vision therapy 2% **occasionally**, 6.7% **seldom,** 80% students improves to **never** have this problem.

For number <u>seven</u> question **pre vision** therapy 16% students **never**, 26.7% **occasionally**, 20% **seldom**, 20% **frequently** & 16.7% **always** had the problem of working in computer. **Post vision** therapy 10% students **seldom** & 90% students improves to **never** had the problem of working in computer.

For number <u>eight</u> question **pre vision** therapy 13.3% students **never**, 6.7 students **seldom,**13.3% **occationally,**23.3% **frequently,**43.3% **always** had the problem of drawing/sketching. **Post vision** therapy 3.3% students seldom & 93.3% students improves to never had this problem.

For number <u>nine</u> question **pre vision** therapy 36.7% students **never**, 13.3% **seldom**, 10% **occationally,**26.7% **frequently,**13.3% students **always** had the problem of knock over things. Post vision therapy 10% students seldom, 90% students improve to never have this problem.

For number <u>ten</u> question **pre vision** therapy 20% **never**, 20% **seldom**, 23.3% **occasionally**, 20% **frequently** and 16.7% students **always** had the problem of words run together while reading. **Post vision** therapy 10% seldom & 93.3% students improve to never have this problem.

For number <u>eleven</u> question **pre vision** therapy 50% students **never,**13.3% **seldom,**10% **occationally,**10% **frequently,**16.7% **always** had problem of buttoning shirt, having food with own hand. **Post vision** therapy 3.3% seldom & 96.7% students improves to never have this problem.

<u>DISCUSSION:</u> -In this study, visual skills were assed to know the status of visual performance, reading rate, binocularity among 130 slow learner students. All slow learner students underwent standard test & few special procedures which are not performed as a part of routine eye examination.

This study provides evidence that slow learner students have other vision related problem(uncorrectedrefractiveerror,amblyopia,H/Osquintsurgery,nystagmus,downsyndromewith amblyopia) also we found a clear evidence that in spite of aided or unaided 6/6 vision this students have the problem of visual skills, decreased reading rate that underlie proficiency in everyday activities .This study provides the information about the status of visual performance in slow learner students and also show us the area of improvement.

Reading and writing are a complex cognitive procedure of decoding symbols in order to construct or derive meaning. Learning to read and reading for information require efficient visual abilities
. the eye must team precisely focus clearly & track quickly across the page. This process must be coordinated with the perceptual & memory aspects of vision, which in turn must combine with linguistic processing & comprehension. To provide reliable information, this must occur with precise timing. Insufficient or poorly developed visual skill requires individuals to divide their attention between the task & involved abilities. Some individuals have symptoms such headaches, fatigue, eye strain, errors; loss of place, difficulty sustaining attention. Others may have an absence of symptoms due to the avoidance of visually demanding task.

With the help of two type of statistical analysis able to conclude that these 130 students have various visual difficulties. 30 of t students among 130 students have other visual conditions, and 30% of them having the problem of visual skill in spite of good visual acuity and 2-3% of students are severe ADHD and data of the visual skill baseline, follow-up after15th days ,follow- up after 30th days was done which show a significant improvement this study is statistically significant(p-value<0.5),and analysis of the value of data of quality of life questionnaires pre and post vision therapy was also done with the help of two type of statistical procedure which shows strong correlation between quality of life pre and post vision therapy.

Here in the study reading rate was improved after vision therapy which support the study by Gary Siglar ED.D et .al [18] association between visual skill level & reading out come by Simon et al, [19] oculomotor vision therapy in improving visual skill by Borila-warford N et al [20].In

this study we also found out problem of visual skill &occulomotor can create an impact on reading performance which supported by otherstudy[28]

Another findings of this study that vision therapy can improve accommodative facility,divergence,convergence supported by another two study[21,22]. Finding of our study that children with learning disability have the problem of deficiency of visual skills supported by the work of Seiderman A et .al and Flax N et.al who found the same result after their work [22,23]another findings of this study that under action or over action of saccadic eye movement have a effect on reading rate, missing out words and which can decrease the efficacy of reading rate be improved by vision therapy supported by other workers.[26,27,28,30,31] In this study we found that proper measurement of fusional vergence at distance and near is very helpful for management purpose and it has its effect on age.[24,25]

other findings of this study that quality of life questioners helpful in found out about correlation between subjective and objective find out pre & post vision therapy which supported by other study. [29]

CONCLUSION: -

Slow learner students have insufficiency of accommodative facility, problem of reduced near point of convergence, deficiency fusional vergence at distance and near, defects of saccades and pursuit movements, poor eye-hand and body-eye coordination though the presence of aided or unaided vision of 6/6 or 6/9. Considering the IQ level of these children they need a greater number of vision therapy sitting than children with normal IQ level. Our findings also co related with the result of questionnaire filled up by the parents. If patient follows proper home vision therapy exercises along with in-office vision therapy exercises the rate of improvement increases. Patient having reading and writing related problem for underdeveloped visual skill definitely improve their academic, sports performance & daily living activities, which will help them to choose them a better carrier option.

AREA OF IMPROVEMENT: -

Hand eye coordination can be measured with standard instrument. Duration of the study should be longer.
Precise measurement of saccades and pursuit can be done with otherinstrument(with improved technologies).
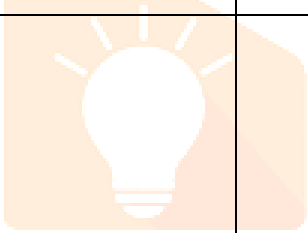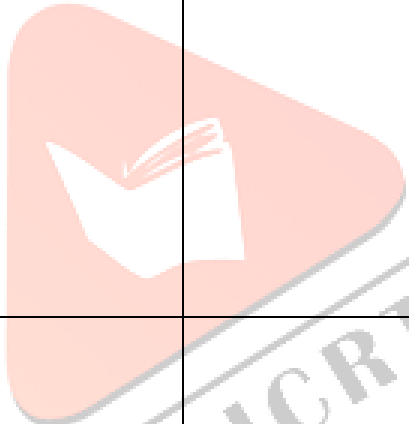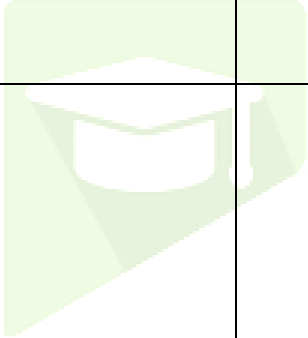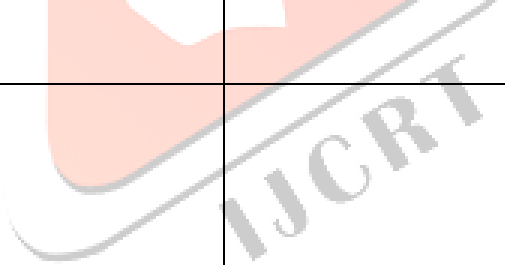
REFERENCE

1. .Clinical and psycho educational profile of children with borderline intellectual functioning;2008;75(8):795-800,August
2. Effect of intervention training on mental abilities of slow learner students;SangitaMalik;Int J EduSci,1(1):61-64;2009
3. .Brown D.S.(2006)counseling students with learning disabilities on social skills. learning disabilities association of America;retriendSeptember,2006from http://www.1damerica.org/about1d/teacher/socialemotional/counseling.asp
4. 4.Throne,G PhD.Graphmotor skills.why some kids hate write.Center for development &learning.reritedSeptember,2006,from http://wwwcd1.org/resource.library/articles/graphmotor:php/type=recent&id=yes
5. GrismD,Sheppardm,TranW.visualsymptpms& reading performance.optometry and visionscience70(5):384-391,1993
6. info@speld-sa.org.au
7. care of the patient with learning related vision problem;American Optometric Association;approved by AOA trusty;June20,2000
8. Definition by American Optometric Associaton;approved by board of trusty of AOA;NOV 1996
9. visual evoked potential study in slow learner,Farah Khaliq et.al;IndianJphysiol.Pharmacol;2009;53(4);341-346
10. Clinical management of Binocular vision,heterophoria,accommodative&eye movement disorders;secondEdition;MitchellScheiman,ODet.al;page;184-188,208-209
11. www.foundationosa.org/slow.htm
12. Clinical management of strabismus;Elizabeth E.Calonoso,OD,1993edition;chapter-17 vision therapytechniques
13. Binocular Anomalies Diagnosis & vision therapy;3rdedition ;JhonGrifinet.al;chapter 14 page 12-18,30
14. www.resdinghorizon.com/ .../optimal-silent & oral readingrates
15. www.hopewell.k12.pa.us/.../.grade-level-reading-ranges
16. www.gio.co.za/documents/fluencyinsilent readind.pdf
17. linc.ed.gov/readingprofiles/calculate_rate.htm
18. Gray Siglar et al;The effect of vision therapy on reading rate :a pilot study;J of behavioral optometry1994
19. Simon HD,Grism JD Binocular anomalies & reading problems.Am J Optom Physio/optuics.1987;58;578-587
20. Bonila-WarfordN,Alison C.A review of the efficacy of oculomotor vision therapy in improving the visual skills.Joptom vis Dev2004;35:108-115
21. CuffredaKj.The efficacy and scientific basis for optometric vision therapy in non strabismic,accommodative,& vergence disordersoptometry.2002;73:735-762
22. SeidermanA.Optometric vision therapy.result of a demonstration project with a learning disable population.J am Optom Assoc.1970:41:841-845
23. Flax N.The contribution of visual problem to learning disabilities .J Am Optom Assoc.1970:41:841-845
24. Fusional vergence measure & their significance in Clinical assessment;Rouse EJ strabismus 2010Jun;18(2):48-57
25. Normal values of distance heterophoria&fusionalvergenceranges&effects of age;palomo Alvarez C et.al;Grafes Arch Cln Exp opthalmol.2006 Jul;244(7);821-4 Epub;2005;Dec

26. *Saccadic Eye Movements;Theory testing &therapy;Gary.Vogal.OD;Journal of optometry;volume 6/1995/page 3-10*
27. *Raynor K.Eye movement in reading & information processing.psycholBull,1978;85:618- 660*
28. *Effect of oculimotor& other visual skill on reading performance;A literature review;optometry visionscience;1996;vol73,no4,pp283-292*
29. *A comparison of subjects with convergence insufficiency & subject with normal binocular vision using a quality of life questionnaire .TravonWhiteet.al;Journal of behavioral optometry;vol15/2004/num2/page37*
30. *Robin Evas;visualtherapy;helping learners who havetroublelearning*
31. *chapter8;officebasedvisiontherapy(VT/Orthoptics)2005;page8-6*

Appendices

READING RATE MEASURMENT

	TOTAL WORDS/ MINUTE	ERRORS	NET WORDS/ MINUTE
INITIAL			
END OF TREATMENT			
IN BETWEEN TREATMENT			

SELECTED COMPREHENSION

QUESTIONNAIRES

NAME:-   AGE/SEX:-   DATE:-

Does your child/student have problem of

	NEVER 0	SELDOM 1	OCCATIONALLY 2	FREQUENTLY 3	ALWAYS 4
1.Copyingfrom board?					
2.Avoiding near work?					
3.Readingcomprehensi Onwhich decline over time?					
4.Iinconsistence/poor performance in sports?					
5.Handling,scissors, Screwdriver, calculator, keys?					
6.Short attention span?					
7.Workingincompute?					
8.Drawing/sketching?					
9.Knock over things on desk or table?					
10.Words run together while reading?					
11.Buttoning shirt, having food with own hand?					

CONSENT FORM

I…………………………………………………………………………..

Here by give my consent for my son/daughter to participate in the study- 'occurrence of vision related conditions & efficacy of vision therapy on their performance"

         I have been explained that all information will be kept confidential & I am prepared to participate in the study

Name-

Date-   ……………....

                                                Signature
                                                Subject's name

Place-