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Investigation Of Astigmatic, Hyperopic And Myopic Eye Patients By Using Different Types Of visual Acuity Charts

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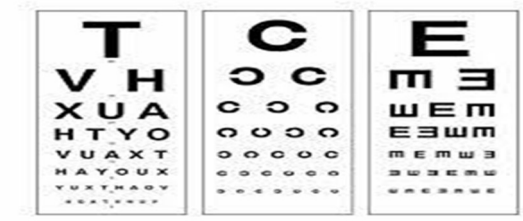
Abstract

this study has been Display what it got when tested VA for astigmatic, hyperopic and myopic patient with different charts (alphabets chart, E chart, Landolt Ring).



Alphabets Landolt ring E chart

the result was surprising, the VA results for same eye has refractive error, is difference when test by different charts (E, alphabets, landolt ring)

the study will open the door for discussion this condition in the future by more research to know why It happen and what the best chart for VA Test.

WHAT IS ASTIGMATISM?

1- Astigmatism is when the cornea and/or lens is oval in shape, like an egg or a rugby ball instead of round, like a soccer ball

2- A surface that is like that of a rugby ball or egg is called a toric surface

3- A toric surface has a different curve in two directions (or meridians): one meridian is steeper (more curved), the other meridian is flatter (less curved)

4- A toric surface causes light entering the eye to focus in two different places, rather than at one single point.

WHAT WILL A PERSON WITH ASTIGMATISM COMPLAIN OF?

1- People with astigmatism may complain of: – Eyestrain (sore, tired, red, dry, or watery eyes) – Headaches – Blurry vision at both distance and near.

WHAT CAN WE DO FOR PEOPLE WITH ASTIGMATISM?

1- Refraction (to determine the correct spectacle prescription they require)

2- People with astigmatism can be given spectacles for clear distance and near vision to stop the headaches and eyestrain

3- Because the two meridians of an astigmatic eye have different powers, the lens that is used to correct it must have different powers in each meridian

4- This is called a cylindrical or astigmatic lens

5- Ready-made spectacles use spherical lenses (not astigmatic lenses) and therefore will not be suitable for people with astigmatism.[1]

1- AUTHOR (s) Brien Holden Vision Institute Faculty: Jane Kierath, Sonja Cronjé, Neilsen de Souza, Shoshana Jackofsky, David Wilson, Mitasha Marolia, Gerd Schlenther, Naomi Freuden, Peter Mohlala Brien Holden Vision Institute, Sydney, Australia/ REVIEWER (s) Bob Chappell Past President: World Council of Optometry (WCO)

*** Introduction**

Snellen's Chart: It is the most commonly used test for visual acuity **(** Visual acuity: is the measurement of spatial resolving capacity of the eye and is applied to central vision. There must be an unstimulated cone in between the two stimulated cones to allow for the resolution of two objects. The distance between two cones at the macular region is 0.004 mm and the object must subtend a visual angle of 1 minute at the nodal point of the eye to produce an image size of 0.004 mm. Based on this principle, distant visual acuity tests are developed.).

It consists of a rows of letters of diminishing size (Fig.1).

Each Snellen's letter is constructed in such way that it can be perfectly placed in a square which is further subdivided into 25 small squares. Each component part of the letter subtends an angle of 1 minute (1/60°) and the whole letter subtends an angle of five minutes of arc at the nodal point of the eye from a particular distance. The largest letter in a top row will subtend an angle of 5 minute at the nodal point if it is 60 metres from the eye. Hence, each row is assigned a specific number which indicates the distance in metres at which a person with normal visual acuity will be able to identify properly the letters (Fig. 2).

Snellen's chart have a single letter at top row and increasingly more letters of smaller sizes in lower rows. The test chart is illuminated by

a lamp of 100 ft (foot candles) cs. The Snellen's chart is read from 6 metre or 20 feet distance.

Interpretation of visual acuity— a. First note the lowest line which a subject can properly identify. b. Visual acuity = Distance viewing (numerator) -over- Lowest identifiable line notation(denominator).

In illiterate patients following two types of optotypes are used to replace the alphabets in Snellen's chart and visual acuity is interpreted on the same principle.

1- Landolt ring: It consists of a graduated series of ring, i.e. a circle with a break or gap in it. Conventionally the break is oriented in four direction—up, down, right or left in different optotypes. The subject is asked to identify the location of the break in each Landolt ring.

2- E chart (or Illiterate chart): It consists of a chart with the graduated series of Snellen's letter "E" oriented in various directions, which the examinee is asked to identify, i.e. the direction to which the limbs of the "E" point (up, down, right or left).[2]

2- Textbook of Visual Science and Clinical Optometry Bikas Bhattacharyya MBBS (Honours), MS, DOConsultant Eye and Laser Surgeon Apollo Gleneagles Hospitals, Kolkata Sambhu Nath Pandit Hospital, Kolkata Wockhardt Medical Centre Kolkata, West Bengal, India (pages from 69 to 72).

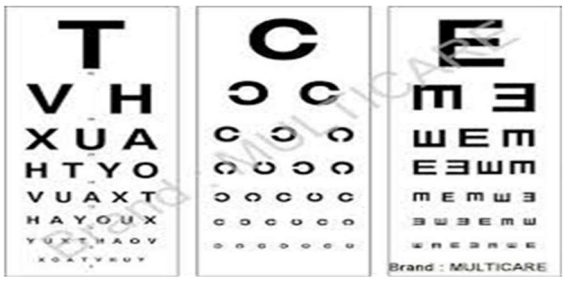


Fig.1

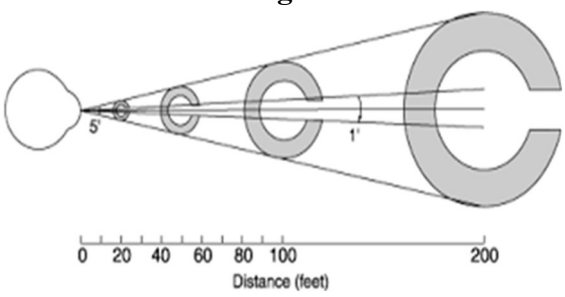


Fig.2

*** Refractive Status Of The Eye**

The refractive status of an eye during minimal accommodation may be of the following types: a.Emmetropia: It is a condition in which parallel rays of incident light are brought to a focus upon the light sensitive layer of the retina during minimal accommodation. It indicates absence of refractive error.

b- Ammetropia: It indicates presence of refractive error, i.e. absence of emmetropia wherein, parallel rays of incident light are not focused on the

light sensitive layer of the retina during minimal accommodation. Ammetropia may be of the following types: -

1- Hypermetropia (or Hyperopia): Incident parallel rays of light are brought to a focus behind the retina.

2- Myopia: Incident parallel rays of light are brought to a focus in front of the retina.

3- Astigmatism: Incident parallel rays of light are brought to a line of focus instead of a]3[inequality in curvature of different meridians.

3- Textbook of Visual Science and Clinical Optometry Bikas Bhattacharyya MBBS (Honours), MS, DO Consultant Eye and Laser Surgeon Apollo Gleneagles Hospitals, Kolkata Sambhu Nath Pandit Hospital, Kolkata Wockhardt Medical Centre Kolkata, West Bengal, India (pages from 118 to 120).

*** Methods**

DISTANCE VISUAL ACTUITY MEASUREMENT PROCEDURE: -

1-This test should be conducted under adequate illumination conditions.

2- One should ensure that there are proper instructions given to the patient. Let the patient know that you are going to assess “how well they can see”.

3- Use the occluder (cover) to cover the patient's LE and record the VA of the RE (Fig.3) One may just suggest that the patient form a cup with the left hand and place it over the left eye, ensuring that the fingers are not placed over the eye and that the patient is not peeking (Fig. 4). One must also ensure that the patient does not apply too much of pressure on the eye because this can blur the vision to a certain extent.

Fig.3

Fig.4

{Thus, if a subject is able to identify upto row of letters on the “24” line from six metre distance, he has a visual acuity of 6/24 or 20/80. A visual acuity of 6/6 (or 20/20) is accepted as normal universally. However, if a patient cannot identify the letter on the top row, his vision is < 6/60 and he is told to walk towards the acuity chart.

1- If he is able to identify the letter of the top row at 3 metre distance, his visual acuity will be 3/60 and so on.
2- If the patient cannot identify the letter even at 1 metre distance, he is asked to count the fingers of the examiner at 1 metre distance. If he is able to count fingers, his visual acuity is counting figures at 1 metre (CF 1m).
3- If he can only identify the hand movement by the examiner, his vision is recorded as hand movements only (HM).
4- If he is still unable to detect any hand movements, he is shifted to a dark room and light is shown on that eye (other eye is covered with palm of the hand) from 4 directions (up, down, right and left). He is asked to specify when the light is present and when it is absent. If he is able to perceive light in all directions, his visual acuity is recorded as perception of light present, projection of rays good (PL+, PR good).
5- If his light perception is absent in any quadrant, it is recorded as PL+, inaccurate projection of rays in that quadrant.
6- If he is able only to perceive light, his visual acuity is perception of light only (PL only).
2- Textbook of Visual Science and Clinical Optometry Bikas Bhattacharyya MBBS (Honours), MS, DOConsultant Eye and Laser Surgeon Apollo Gleneagles Hospitals, Kolkata Sambhu Nath Pandit Hospital, Kolkata Wockhardt Medical Centre Kolkata, West Bengal, India (pages from 69 to 72).}
4- next,proceed to occlude the RE and record the VA of the LE.
5- Remove the occluder and record the VA of both eyes.
6- Don't correct any mistakes that the patient may make. If the patient reports that he can no longer see, urge him to try a few more letters by pointing out letters that you know are easier than others so that you get an accurate assessment of the limit of his VA. We conventionally record the VA of the right eye, then the left eye, followed by both eyes.
7- is important that one avoid memorization of the letters on the chart. This is best done if one knows which of the eyes is the poorer of the 2, and then this eye should be tested first. Another way to prevent memorization would be to allow the patient to read the letters first without the habitual Rx and then with.
8- One needs to ensure that the patient is not peering (sometimes referred to as squinting) in order to get better visual acuity. This action creates a pinhole effect thereby allowing the patient to resolve

smaller letters than he/she ordinarily would without peering.

9- If the patient has an abnormal head posture, one needs to determine if it's a posture that he assumes in order to see clearly, if not, instruct him to keep his head in the upright position. If it is a corrective head posture to obtain better vision (like in the case of patient's who have media opacities that cause low vision), the practitioner must make note of the abnormal head posture.

10- Another method to prevent memorization is to have the patient read the line of letters in reverse. [4]

4- AUTHOR (S) Pirindhavellie Govender: University of KwaZulu Natal (UKZN) Durban, South Africa/ PEER REVIEWER (S) Bina Patel : New England College of Optometry, United States.

*** The autorefractor**

is an instrument that approximates the error of the eye Fig.5. It refractive measures the length of the eye and the shape of the cornea and then approximates what the glasses prescription should be.

Some instruments also provide corneal curvature readings (K readings). The doctor or the technician uses this information as a starting place for refractometry, the process which results in a final glasses prescription.

*** Autorefraction procedure**

-Most autorefractors are easy to operate.
-The patient is aligned in a headrest.
-The operator views an image of the cornea on the screen.
-There are reflections (mires) that must be focused on the cornea for proper alignment.
-Once alignment is achieved, a button is pushed to capture the measurement.[5]
[5]https://ophthalmictechnician.org/index.php/courses/front-desk-receptionist-training/130-autorefractor-and-autolensometer

Fig.5

WHAT IS MYOPIA?: -

1- Myopia is when light from a distant object focuses in front of the retina Fig.6.

2- A person who has myopia is called a 'myope.' Myopia is often called "shortsightedness" – because a person with myopia will have near vision that is better than their distance vision, no matter what age they are.

WHAT CAUSES MYOPIA?: -

1- Myopia may be caused by: -

a- an eyeball that is too long.

b- a cornea and/or a crystalline lens that is curved too much and, therefore, too strong in power.

WHAT WILL MYOPES COMPLAIN ABOUT?: -

1- People with myopia usually complain of blurry distance vision

2- They may tell you that they cannot recognise people who are far away

3- They may also tell you (or you may notice) that they see better when they almost close their eyes ("screw up" or "squint" their eyes)

4- Myopic people often find that their vision seems worse at night or in dim light.

WHAT CAN WE DO FOR PEOPLE WITH MYOPIA?: -

1- Refraction (to determine the correct spectacle prescription required)

2- People with myopia can be given spectacles to see more clearly in the distance

3- Myopia is corrected with minus spherical lenses.

WHAT IS HYPEROPIA?: -

1- Hyperopia is when the light from a distant object focuses behind the retina Fig.7.

2- A person who has hyperopia is called a 'hyperope.

3- Hyperopia is sometimes also called "longsightedness" or "farsightedness".

WHAT CAUSES HYPEROPIA?:

1- Hyperopia may be caused by: -

a- an eyeball that is too short.

b- a cornea and/or crystalline lens that is too flat (not curved enough) and, therefore, too weak in power.

WHAT DO PEOPLE WITH HYPEROPIA COMPLAIN OF?: -

1- The symptoms of hyperopia vary depending on how much accommodation can be used (how old the person is), and the amount of hyperopia they have

2- However, most people with hyperopia complain of difficulty seeing at near – often they tell you that their near vision is worse than their distance vision

3- People with hyperopia may also complain of: -

a- Eyestrain (sore, tired, red, dry, or watery eyes)

b- Difficulty reading or doing near tasks

c- Poor distance vision, especially if they are older and have high hyperopia

d- Vision that seems worse at night or in dim light

qWHAT CAN WE DO FOR PEOPLE WITH HYPEROPIA?: -

1- Refraction (to determine the correct spectacle prescription they require)

2- People with hyperopia can be given spectacles to see more clearly up close and these spectacles may also be prescribed for distance

3- Hyperopia is corrected with plus spherical lenses

WHAT IS ASTIGMATISM?

1- Astigmatism is when the cornea and/or lens is oval in shape, like an egg or a rugby ball instead of round, like a soccer ball

2- A surface that is like that of a rugby ball or egg is called a toric surface

3- A toric surface has a different curve in two directions (or meridians): one meridian is steeper (more curved), the other meridian is flatter (less curved)

4- A toric surface causes light entering the eye to focus in two different places, rather than at one single point.Fig.8.

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1- People with astigmatism may complain of: – Eyestrain (sore, tired, red, dry, or watery eyes) – Headaches – Blurry vision at both distance and near.

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4- This is called a cylindrical or astigmatic lens

5- Ready-made spectacles use spherical lenses (not astigmatic lenses) and therefore will not be suitable for people with astigmatism.[1]

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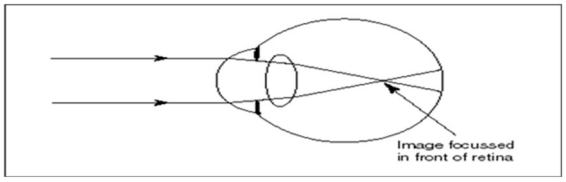

Fig.6

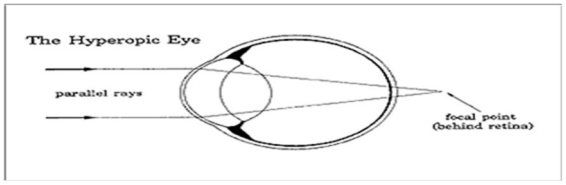

Fig.7

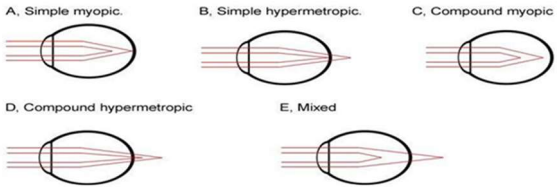

Fig.8

Lenses: -

SPHERICAL LENSES: -

Spherical lenses correct refractive errors unaccompanied by

astigmatism. A spherical lens is defined as a lens in which each surface forms a part of the surface of a sphere Fig.9. However, a plane surface may be considered as part of a spherical surface of infinite radius. Power of spherical lens is expressed in diopter spherical (DSPH).

TYPES: -

*** Convex or Plus Lens**

Convex lenses are worn by patients who are hypermetropic, i.e. farsighted. The image of an object falls behind the retina in hypermetropic people, and convex lens converges parallel rays of light to bring the image forward on the retina.

How to identify convex lens?: -

1- It magnifies images, i.e. makes them larger.

2- When the lens is moved in front of the eye, the object moves in the opposite direction. This is called against movement.

3- The lens is thicker in the middle and thinner on the edges.

4- The greater the vertex distance (further away from the eye), the stronger the power, i.e. magnification of the lens.

5- It is conventionally denoted by plus (+) sign in trial lenses. Uses: It is used in the treatment of: -

1- Hypermetropia

2- Presbyopia

3- Aphakia

4- In low visual aids as magnifier.

*** Types of convex lenses**

The power of each surface of a lens add up to arrive at the power of the lens as a whole. So, the total power desired is distributed between the two surfaces. Convex lenses are usually available in following standard forms; -

1- Equiconvex: Both surfaces have the same curvature, i.e. same plus (+) power . Nowadays, this spectacle lens form has become obsolete.

2- Planoconvex: The surface facing the eye, i.e. back surface is plane and the front surface provides the necessary plus/ convex power .

3- Plus/Convex meniscus: This is the usually available form of plus/minus spectacle lenses. Conventionally, the front surface is always convex and the back surface is always concave , in plus/minus meniscus lenses.

*** Concave or Minus Lens**

Concave lenses are worn by patients who are myopic, i.e. nearsighted. In myopia, the image of an object falls in front of the retina , and concave lens diverges the parallel rays of light to shift the image behind, on the retina .

How to identify concave lens?:-

1- It minifies images, i.e. makes them smaller.

2- When the lens is moved in front of the eye, the objects move in the same direction. This is called with movement.
3- The lens is thinner in the middle and thicker on the edges.
4- The greater the vertex distance, the weaker the power of the lens.
5- It is conventionally denoted by minus (–) sign in trial lenses.
Uses: It is used in the treatment of:

*** Myopia**

Some optical diagnostic and laser lenses, e.g. Hruby lens (–58.60D), central concave lens of single/two/three mirror gonioscopic lenses (–64.00D). Types of concave lenses: Like convex lenses, concave lenses are usually available in following standard forms; -
1- Equiconcave: Both the surfaces are symmetrically concave. Like equiconvex lens it is also obsolete.
2- Planoconcave: The front surface is plane and the back surface, i.e. the surface facing the eye provides the necessary minus/ concave power .
3- Minus meniscus: Minus lenses are marketed in this standard form .

*** CYLINDRICAL LENSES**

Cylindrical lenses correct regular astigmatism. It is a segment of a cylinder of glass cut parallel to it's axis Fig.10.

HOW TO IDENTIFY A CYLINDRICAL LENS ?

1- Conventionally, cylindrical lens has one toric surface, i.e. a surface having meridians of least and greatest curvature aligned at right angles to each other.
2- Conventionally, two marks are seen on the peripheral/outer part of the lens, which indicate the axis of the lens.
3- When the lens is moved in the direction of the axis, there is no movement of the object. The meridian of the least power, i.e. curvature is the axis of the cylindrical lens.
4- When the lens is moved in a direction at right angles to its axis, i.e. the meridian of greatest curvature, the movement of the object depends on the convexity/concavity of the cylindrical glass. In convex cylindrical lens the object moves in the opposite direction (against movement). In concave cylindrical lens the object moves in the same direction (with movement).
5- Cylindrical power is expressed in diopter cylinder (DCYL). A plus (+) sign denotes convex cylindrical lens and a minus (–) sign denotes concave cylindrical lens in the trial lenses.

TYPES OF CYLINDRICAL LENSES: -

1- Planocylindrical lens—In planocylindrical lens, one meridian

contains no power and is the axis of the lens. The toroidal meridian, i.e. the meridian of greatest curvature is located at right angle to the axis.

2- Spherocylindrical lens—It contains spherical component throughout the lens.

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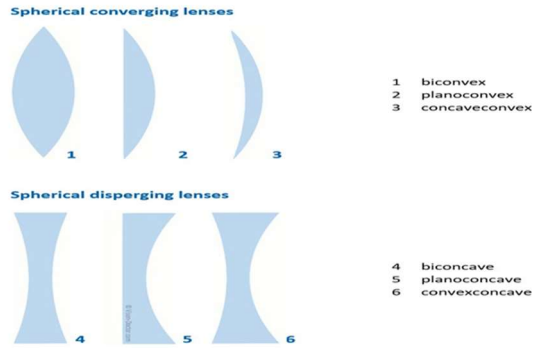


Fig.9

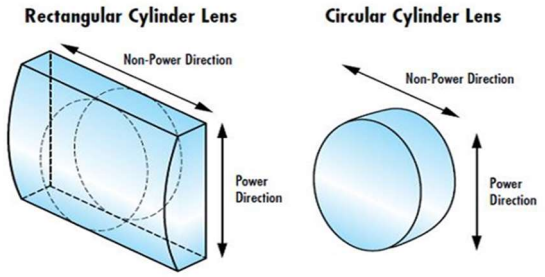
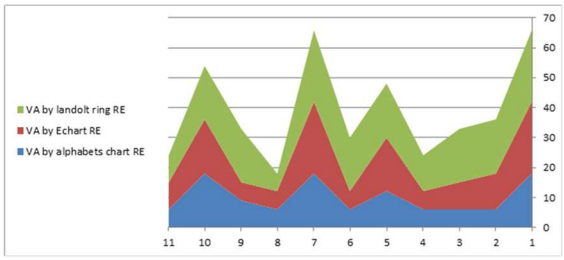


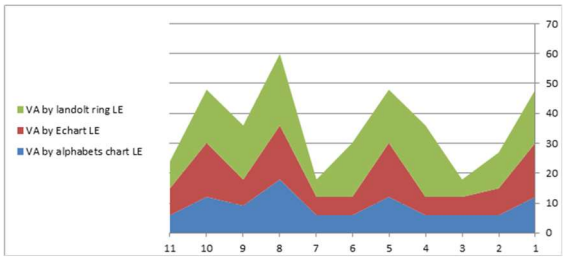
Fig.10

* Results

case No.	Type and degree Of Refractive error		VA BY alphabets Chart		VA by E Chart		VA by Landolt Ring	
	RE	LE	RE	LE	RE	LE	RE	LE
1	-1.00DCx120	-1.00DCx105	6/18	6/12	6/24	6/18	6/24	6/18
2	-0.75DCx70	-0.75DCx160	6/6	6/6	6/12	6/9	6/18	6/12
3	-1.00DCx130	0.00	6/6p	6/6	6/9	6/6	6/18	6/6
4	+0.5DCx55	+0.5DCx100	6/6	6/6	6/6	6/6	6/12	6/24
5	-2.25DCx170	-2.25DCx80	6/12	6/12	6/18	6/18	6/18	6/18
6	-0.5DCx40	-0.5DCx90	6/6	6/6	6/6	6/6	6/18	6/18
7	-1.25DCx50	0.00	6/18	6/6	6/24	6/6	6/24	6/6
8	0.00	+1.5DS	6/6	6/18	6/6	6/18	6/6	6/24
9	-0.75DS	-0.75DS	6/9	6/9	6/6	6/9	6/18	6/18
10	-1.5DS	-1.5DS	6/18	6/12	6/18	6/18	6/18	6/18
11	-0.5DS	-0.5DS	6/6	6/6	6/9	6/9	6/9	6/9
12	-1.75DCx20	0.00	6/12	6/6	_	_	6/18	6/6
13	-0.5DCx40	-0.5DCx90	6/12	6/12	_	_	6/9	6/9
14	+1.00DS	+1.25DS	6/12	6/18	_	_	6/18	6/24
15	0.00	-0.75DS	6/6	6/9	_	_	6/6	6/9
16	+1.00DS	+1.00DS	6/9	6/9	6/9	6/9	_	_
17								



(graphic representation 1) the right eyes VA average for each chart (E, alphabets, landolt ring)



(graphic representation 2) the left eyes VA average for each chart (E, alphabets, landolt ring)

* Discussion

The results and his graphics show clearly the best VA results has been achieved by alphabets chart then E chart ,and the worse VA results has been achieved by landolt ring chart.

This difference in results leads us to work more on the research topic in the future and open the door to more researches in this regard, to find

out why this difference occurs, although the all charts designed on the same scientific principle.

The next researches must also determine the best chart for visual acuity examination, in terms of accuracy to rely on to diagnose the patient.

The major limitations for this study is time because the patients can not wait for much time until you do many tests, because you must explain the test for patient and take history ,refraction , VA for each chart (E, alphabets, landolt ring), so this will take much time make the patient bored.

*** Conclusion**

I think the shape of optotype is important and it make the difference in results, because the design of snellen chart is depend on the size of optotype and nodal point of eye without taking into account the shape of optotype, so I think it make the difference.

The difference in VA among different chart may not be simple problem because some disease (like amblyopia) need accurate VA test, mean the VA must not change when do test with other chart.

For example if we follow up a case with amblypoia to see how much it improve, and with first appointment we noted his VA was 6/12 in myopic eye when we tested he with(E chart) .and at second appointment we saw his VA did not improve because we tested he with(landolt chart) , at that time the difference in results between charts will matter.

*** References**

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https://ophthalmictechnician.org/index.php/courses/front-desk-receptionist-training/130-autorefractor-and-autolensometer

Textbook of Visual Science and Clinical Optometry Bikas Bhattacharyya MBBS (Honours), MS, DOConsultant Eye and Laser Surgeon Apollo Gleneagles Hospitals, Kolkata Sambhu Nath Pandit Hospital, Kolkata Wockhardt Medical Centre Kolkata, West Bengal, India (pages from 170 to 174).