The Neotia University

THE NEOTIA UNIVERSITY
ज्ञानम् आत्म प्रदीपाय

Dispensing Optics II
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PRACTICAL 1: FINDING OUT THE MERIDIAN & OPTICAL CENTER OF OPHTHALMIC LENS

Introduction

Optical centre of a lens is a point with in or on the lens, any light ray passing through it will not be deviated. So power at that particular point is zero. The optical centre of the lens has to coincide the centre of the pupil to avoid prismatic effect. Hence there is significant of determining the optical centre of a lens.

Principle/ Theory

Hand neutrilisation is a procedure by which power of a unknown lens can be determined by neutrilising it with another lens with known power. The neutrilisation is based on the fact that when an object is viewed through a lens and the lens is moved, there will also be movement of the image of the object and the movement is dependent on whether the lens is convex or concave. The movement of the image is with the lens if the lens is concave and vice versa.

The image formed by the lens stops moving once the the power of the lens is neutrilised with a lens of equal but opposite power.

Apparatus required

1. Trial lenses
2. A white paper with a perpendicular cross drown on it.

Procedure

- ✧ The lens is hold on the perpendicular cross in such a way that there is gap between the lens and the cross.
- ✧ The image of the cross is viewed through the lens and assessed if it is perpendicular. If the image of the cross is not perpendicular, then the lens is a cylindrical or spherocylindrical one. In this case there will be scissoring of the cross by rotation. The lens is then rotated till the cross becomes exactly perpendicular. These are the principal meridian of the lens.
- ✧ Hence the lens is moved right to left and up and down to make the cross image exactly overlapped with the line of the object cross.
- ✧ The optical centre is marked with a felt tip pen.

Results & Observations

The point at which the cross marks intersect with the lens is the optical centre of the lens.

If the image of the cross through the lens can not be aligned with the cross object by moving the lens up-down and side wise. The lens is grounded with prism and the prism has to neutrilised before determining the optical centre.

PRACTICAL 2: FINDING OUT THE MERIDIAN & OPTICAL CENTER OF OPHTHALMIC LENS BY LENSOMETER

Introduction

Lensometer is an instrument by which back vertex power and front vertex power of a lens can be measured. It measures power of the lens and determines the axis of the lens more accurately in comparison with hand neutrilisation method. The purposes of lensometry are to determine the prescription of pair of spectacles, verifying the accuracy of fabricating glasses and duplicating the lens prescription in laboratory.

Principle/ Theory

The lensometer works on Badal principle which states that if the eye is placed at the focal point of a positive lens, the virtual image of an object located between the lens and the anterior focal point will always subtend the same visual angle.

A lensometer consists of an illuminated target which is movable, a powerful convex lens and a afocal telescope as eyepiece. When a lens of unknown power is introduced, the image of the illuminated target is made out of focus. The refractive power of the unknown lens can be measured by moving the illuminated target closer to or further from the convex lens.

Apparatus required

1. Lensometer
2. Trial lenses

Procedure

- ✧ The lensometer is fixed at a comfortable viewing positioned and the instrument is locked.

The eyepiece focusing

- ✧ The eyepiece is rotated first counterclock wise to make the reticule blur
- ✧ The eyepiece is then turned clockwise to make the reticule clear.

Power calibration

- ✧ With no power or plano power the instrument is switched on.
- ✧ The power wheel is first turned into plus and then it is rotated in opposite direction until the sharpest focus of the mire is achieved. The power wheel should indicate zero if the instrument is properly calibrated.
- ✧ If the power wheel doesn't indicate zero, refocusing of the eyepiece or rechecking of calibration is needed.

Determination of the Optical centre

- ✧ The spectacles are placed on the frame table in such a way that the back surface of the spectacles faces the table top and the rim of the spectacles rest on the frame table.
- ✧ The spectacles are moved side to side and up and down to bring the target mire at the centre of the reticule.

- ✧ Clamp is put on the spectacles and mark the centre with a marking pin attached to the lensometer.

Determination of power

- ✧ With the lens positioned in its optical centre, the power wheel is rotated toward plus or minus until the target mire gets clear.
- ✧ In case of spherical lens all the mires become equally clear where as in case of cylinder or spherocylinder target mire in one direction only gets clear.
- ✧ To measure the astigmatic lens the power wheel is rotated until the mire in one direction gets clear.
- ✧ The axis wheel is then rotated until three parallel lines are straight and unbroken.
- ✧ The number on the power wheel is the power of spherical power.
- ✧ The power wheel is further is rotated until the mires on other meridian become clear and the reading on the mire is noted.
- ✧ Cylinder power is the difference between first and second reading.
- ✧ The axis of the cylinder is the direction of the second power reading. It is recorded from the axis wheel.

Results & Observations

Power of the lens: ____ Dsph ____ Dcyl @ ____

PRACTICAL 3: LENS-SURFACING & EDGING, CUTTING & MARKING

Lens surfacing

Surfacing is the process by which a prescription is placed onto a lens and preparing its surface prior to being cut for the frame. Although large commercial ophthalmic labs do their own surfacing, this is not a process typically done at the small in-office lab.The following steps are involved with the lens surfacing.

Marking :

- To correctly locate the lens for different stages of surfacing ,certain markings are essential.
- Optical center position ,cylinder axis, base apex direction in case of prism.
- Done by marking with suitable ink or jugging at blocking stage.

Blocking:

- The block holds the lens in place through entire surfacing process.
- Alloy or wax is used to hold the lens blank to the surfacing block.

Grinding:

- Optical surfaces on glass are produced by the process of grinding and polishing.
- First stage is removing the unwanted materials from the lens surface. This is followed by trueing and smoothing.
- Roughing is performed by machines known as surface generators and the process is termed as generating.
- The grinding agent is usually a diamond – bonded disc or wheel, termed as lap.

Polishing:

- The polishing tools are lined with pads cut from polyurethane sheets.

De –blocking & cleaning:

- The process of polishing is completed ,the lens is separated from its holder (De-blocking) and cleaned properly.
- Lacquer can be used for cleaning.

Lying off

Marking of cylinder axis ,optical center in the correct position relative to the lens shape. □ Can be use focimeter ,marking devices and a specially designed protractor.

Lens cutting

Scoring a slightly oversize outline of the desired shape on one surface of the uncut lens and removing the waste. _

Lens cutting can be performed entirely by hand or with the aid of a wheel cutter.

Edging

An edger is a lathe, using a diamond or ceramic grinding wheel, which cuts the blank to the shape of the frame. This process is called "Edging".

A pattern or a tracer is used to trace the frame shape directly. A pattern is a plastic disc the exact size and shape the lens needs to be in order to fit the frame.

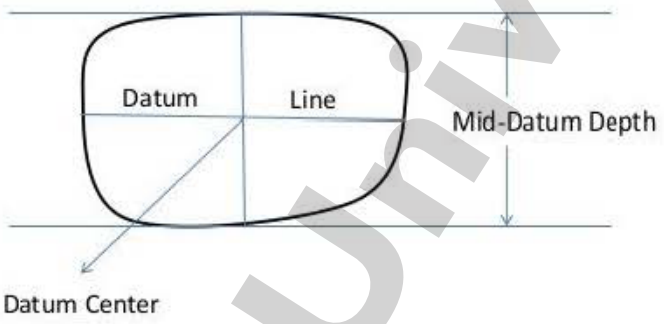
If a pattern is not available, the frame is placed into a tracer, a machine that traces the shape of the frame.

PRACTICAL 4: FRAME MEASUREMENT: THE BOXING SYSTEM, THE DATUM SYSTEM

Introduction

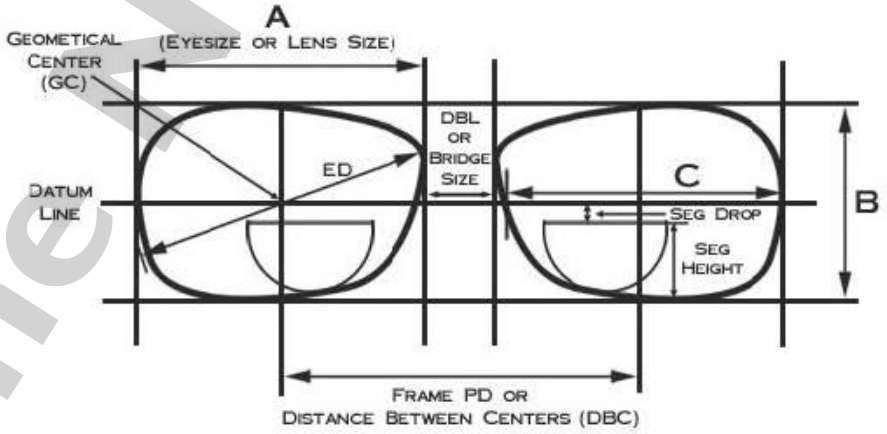
The best frame for a patient complements his/her facial structure, more importantly holds the lenses in proper position infront the eye. Frame with proper size and position is also helpful in maintaining the optical quality of the image. Hence measurement of frame has got specific importance in selecting particular frame for a particular patient.

Datum System



- ✧ A horizontal line drawn at the highest and lowest edges of the lens.
- ✧ A parallel line drawn midway between the horizontal lines is known as the Datum line.
- ✧ The distance between the horizontal line is called the Datum length or the eye size.
- ✧ The point along the Datum line half way between the edges of the lens is called Datum centre.
- ✧ The Datum depth which is measured at the Datum centre is called Mid Datum depth.

Boxing System



- *Horizontal Mid line:* It is an imaginary line halfway between the top and bottom of the lens.
- *Geometrical centre:* It the point on the Horizontal Mid line which is situated at halfway between the two vertical line bordering the lens sides.
- *Lens Size:* The lens size is denoted as the horizontal and vertical length of the box in millimeter.
- *Distance between the lenses (DBL):* It is the distance between the two boxes.
- *Distance Between Centers (DBC):* It is the horizontal distance between to geometric centers of the lenses.
- *Effective diameter (ED):* It is measured as twice the distance from the geometric center of the lens furthest edge of the lens shape.
- *Seg Height:*It is the vertical distance between the bottom edge of the box and the top of the bifocal or trifocal segment.
- *Seg Drop:*It is the vertical distance between the Datum line and the top of the bifocal or trifocal segment Overall.
- *Temple Length (OTL):*Temple length is the running distance between the middle of the center barrel screw hole and the end of the temple.
- *Length to Bend (LTB):*It is measured as the distance between the center of the barrel and the middle of the temple bend.
- *Front to Bend (FTB):*FTB is the distance between the plane of the front of the frame and the temple bend. Used if there is a significant distance between the frame front and the beginning of the temple.

PRACTICAL 5: MEASURING INTER-PUPILLARY DISTANCE

Introduction

Interpupillary distance is the distance between the centre of the pupil of both the eyes which is measured in millimeter. As we know that the optical centre of the spectacle lens should coincide with the center of the pupil to attain optimum optics, there is specific importance of iterpupillary distance. There might be misplacement of the optical centre if the IPD is not measured. Which may induce prismatic effect and finally resulting in non-strabismic binocular vision disorder.

Principle/ Theory

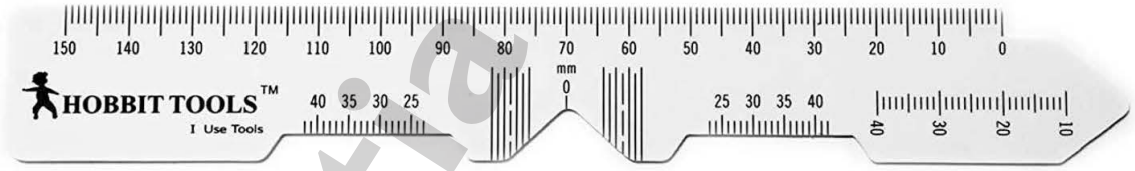
Distance PD: It is the distance between the centre of the pupils when looking at a distance target.

Near PD: Near PD is the distance between the centre of the pupils while looking at a near target.

*Near Centration Distance:*Near Centration Distance (CD) is the distance between the visual axes in a spectacle plane when viewing a near target.

Apparatus required

1. PD ruler

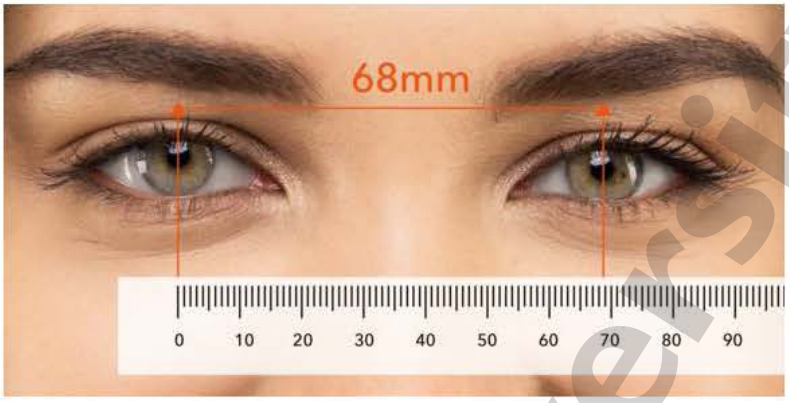


2. Pen torch

Procedure

Binocular Distance PD

- ✧ The patient is made seat at a distance of 40 cm infront the examiner so that the patient's eyes and the examiner's eyes situated at the same line.
- ✧ The patient is asked to look at the examiner's left eye while the examiner closes his/her right eye.
- ✧ 'Zero' point of the PD ruler is then aligned with the patient's right pupillary centre.
- ✧ Now the examiner closes left eye while the patent fixes at the examiner's right eye.
- ✧ The reading is taken directly from the point on the scale that is aligned with the pupillary centre of the left eye.



- ✧ Interpupillary distance can also be measured from the pupillary margin or limbus of one eye on the nasal side to the pupillary margin or limbus of other eye on the temporal side.

Monocular Distance PD

- ✧ The binocular distance PD is measured first as discussed earlier.
- ✧ Now fixing the 'Zero' point of the ruler with the centre of pupil of one eye, the scale reading at the centre of nasal bridge is noted. This is the monocular PD of one eye.
- ✧ The monocular PD of the other eye is achieved by subtracting the monocular PD of one eye from the binocular distance PD.

Monocular Distance PD

- ✧ The patient is made seat in such a way that the examiner's dominant eye is directly infront of the patient's nose at the patient's near working distance.
- ✧ The patient has to fix at the examiner's dominant eye while the examiner closes his/her non-dominant eye.
- ✧ Now the 'Zero' mark of the PD ruler is aligned with centre of the examiner's right pupil.
- ✧ The scale reading form the examiner's left pupillary centre is noted.

PRATICAL 6: MEASURING HEIGHTS :- SINGLE VISION , BIFOCAL, MULTIFOCAL, PROGRESSIVE LENSES

Introduction

It does not matter whether the spectacles are single vision, bifocals, multifocals or progressive, the optical quality will be inferior if the lens is placed at proper position before the eye. There might be optical errors like prismatic effect if the lens is not coincided with the centre of the pupil. So following the guideline to measure the fitting height is very much important.

Apparatus required

3. PD ruler
4. Measuring scale
5. Marker Pen
6. Pen Torch
7. Centration chart for Progressive lenses

Procedure

Single Vision Lens:

- ✧ Frames are adjusted to fit the wearer, givingattention to nosepads, frame height,pantoscopic tiltand straightness of the frame on the face.
- ✧ Fitter has to positions himself or herself on the same levelas the subject.
- ✧ Subject is asked to fixate on bridge of fitter's nose.
- ✧ Wearer's chin is tilted back until frame front isperpendicular to the floor.
- ✧ The location is marked of the pupil centers withshort horizontal lines on the glazed lens.
- ✧ MRP height is measured as distance from lowestportion of the inside bevel of the lower eyewire to theline on the glazed lens.

Bifocals:

- ✧ Fitter has to position himself or herself on the same levelas the subject.
- ✧ Subject is asked to fixate the bridge of the fitter's nose.
- ✧ Holding frame in correct wearing position, the PD rule is placed vertically in front of subject's righteye. The zero point is at lower limbus and the rulerscale is positioned downward.
- ✧ For a rimmed frame, the scale reading is taken at thelevel of the lowest point where the inside of thegroove would be. For a rimless frame, the referenceis the level of thelowest point on the demo lens.
- ✧ Repeat for left eye.

Tiifocals:

- The techniques for measuring trifocals are identical tothose for measuring bifocals, except the reference is thetop of the trifocal intermediate segment rather than thetop of the lower near segment.

ProgressiveLens:

- At first monocular distance PDs are measured.
- The actual frame to be worn is fitted and fully adjusted.This includes pantoscopictilt, frame height, vertexdistance, face form, and nosepadalignment.
- The dispenser has to position with his or her eyesat the wearer's eye level. With the wearer looking atthe bridge of the fitter's nose, ahorizontal line is drawn on the lens. The line shouldgo through the center of the pupil. This is done forboth right and left eyes.
- The frame is placed on the manufacturer's centrationchart and it is moved left or right until the bridge iscentered on the diagonally converging centralalignment pattern. Then the frame is moved up ordown until the marked horizontal pupil center linesare on the chart's horizontal axis.
- The previously measured PD is marked for each eye as avertical line that crosses the horizontal one.
- The fittingcross heights reading for the two lenses are taken and recorded from the chart.