PRINCIPLES OF AUTOREFRACTOMETER

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ABSTRACT:

This paper describes about Principles of Auto Refractometer.

INTRODUCTION:

Auto Refractometer is an instrument by which we can assess Spherical, cylinder and Sphero cylinder power easily. In this instrument, Near Infrared Radiation (NiR) is used to determine Refractive Error.

NiR is used due to more reflection from the fundus is happen compare to normal Radiation, and another reason is in presence of NiR, patient does not feel photophobia, pupil constriction and Accommodation is unaffected.

Main disadvantage of the NiR is – It is more scattered from the fundus compared to other Radiation.

Auto Refractometer achieves end point of the Refractive Error by

A. Nulling Principle
B. Open loop condition

A. To understand the Nulling Principle have to understand of 'NULL POINT'. In Eso deviation 'NULL POINT' is in the Nasal Retina and in the Exo deviation 'NULL POINT' is in the Temporal Retina. So to find out refractive error Auto Refractometer finds the 'NULL POINT'. This is the Nulling Principle.

B. Here very briefly describes about 'Open loop condition'-

(a) In case of EXO DEVIATION- CROSSED RETINAL DISPARITY is occur
(b) In case of ESO DEVIATION- UNCROSSED RETINAL DISPARITY is occur

That's why brain sends stimulation to the both eyes for Orthophoria. For the (a) eye will be towards NOSE and for the (b) eye will be towards EAR/OUT. It is called "CLOSED LOOP" condition.

When one eye is closed then stimulation will be prevent, then it is called "OPEN LOOP" condition.

The Principles of Auto Refractometer are as follows:

SCHEINER PRINCIPLE:

It consists of opaque disc in which two apertures are present and these apertures are equidistant from the centre of the disc.

In case of Emmetropia, whatever the NiR are coming from the Near object, that will be passing through these two holes and are focused as a point on the Retina, and patient is observed at a particular point and Accommodation is in rest condition.

In case of Myopia, whatever the NiR are coming from the near object, that will be passing through these two holes and the beam would illuminate two areas of fundus, and it is focused in front of the Retina and Accommodation is in Rest condition.

In case of Hypermetropia, whatever the NiR are coming from the near object, that will be passing through these two holes and the beam would illuminate two areas of fundus, and it is focused behind the Retina and Accommodation is in Rest condition.

RETINOSCOPIC PRINCIPLE

Here, fundus reflex is being observed. Regarding Fundus Reflex, two characteristics are being seen.

i. Direction of the motion of the Fundus Reflex compared to Incident beam.
ii. Speed of the motion of the Fundus Reflex compared to Incident beam.

BEST FOCUS PRINCIPLE:

To achieve the Neutralization, here actually highest contrast is being assessed during the target is focused on the Retina.

In case of Emmetropia, the images of a target are focused properly on the Retina and achieved highest contrast. But sometimes, images are focused on the Retina but Contrast level is deteriorated due to mild defocused on the Retina of the images of an object. By the changes of the vergence of the Incident rays may achieve best focus and highest contrast.

KNIFE EDGE PRINCIPLE

This Principle is used to assess Refractive uniformity of the lens or mirror. The meaning of the Knife Edge Principle is “Here, point edge is focused at the edge of the Linear flat opaque surface and this edge is like a Knife Edge.” When Knife edge Principle is followed for to assess Refractive Uniformity of the lens.

When Knife edge Principle is followed in Auto Refractometer, then two things are present.

i. Sharp (like knife) linear opaque surface is present.
ii. Mirror

In this case, this knife edge is placed at in front of the lens and mirror placed at back of the lens. Here, knife edge is a source of the light. So here, whatever the reflection is created that is “Retro Reflection” because mirror is behind the lens and light source is in front of the lens.

After that, by moving the knife edge along with the optic Axis of the lens, their image can be made optically conjugate. Then Principle of the Reversibility, all light will be reversed to the sound of the object. So, theoretically no light will escape at the area of the knife edge.

RAY DEFLECTION PRINCIPLE:

When NiR are reflected from a patch of fundus source on that time these rays are exist from the eye and it is refracted to the images of the secondary fundus source and along with optic axis of the eye. In case of Emmetropic eye, the exit rays are parallel to each other. In case of Myopic eye, the deflection (direction of change) of rays will be in front of the eye, in the far point plane. This deflection (direction change) is looking like; the rays come from the plane which is back of the "Hyperopic eye." This deflection is compared to collimated (make) parallel rays. This instrument measures the linear deflection fundus images in three or more meridians at a fixed distance from the eye, and Trigonometrically (Mathematically) measures the Angular deflection of rays and position of the far points which computes the full Refractive error

AUTO REFLECTION BASED ON IMAGE SIZE OF THE FUNDUS REFLEX

Here, fundus image size is measured at three or different meridians and calculates the Refractive error on the basis of ocular magnification and ocular minification compared to Emmetropia.

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