SCLERAL INDENTATION: EVALUATION OF PERIPHERAL RETINA THROUGH TECHNICAL PROCEDURE, INSTRUMENTATION COMPARISON AND PATIENT PERSPECTIVE

by

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Scleral Indentation in the Evaluation of Peripheral Retina Through Technical Procedure, Instrumentation Comparison, and Patient Perspective

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An evaluation was made of 30 patients who were known to have some form of peripheral retina degeneration or abnormality. The patients were subject to three different techniques used to examine the peripheral retina; Binocular Indirect Ophthalmoscopy, the Goldmann Three-Mirror Lens, and Scleral Indentation. Both objective and subjective opinions were formed as the comparison between techniques and instruments ensued. Scleral indentation frequently demonstrated the peripheral abnormalities were very observable by ophthalmic examination. This paper suggests that scleral indentation is an advanced yet simple procedure that is painless for the patient and convenient for the doctor.

Normal Anatomical Landmarks

The geographic areas of the retina comprise of the posterior pole, the equatorial zone, the peripheral retina, and the ora serrata (which is the most anterior structure). Since the equatorial to oral zones represent the thinnest retinal areas, it is esential to be able to examine these regions with means other than a direct ophthalmoscope, which is limited in reach. Therefore, different instrumentation and techniques shall be explained to assist in better diagnosis and patient care. Also, an anatomical review of the landmarks to be aware of will further aide in the sighting and evaluation of such regions.

Equatorial Zone

To inspect the retina correctly and efficiently, one must know exactly where one is located on the retina. The equator of the retina has no real specific function other than allowing the observer to mark the separation of central from peripheral fundus and therefore, localizing themselves. It may be identified clinically in relationship to the location of the vortex veins. There are four main vortex veins that vary in size, shape, and color. These choroidal veins are generally reddish in color and lie approximately 6 to 8mm behind the equator.[1] In this region, the long posterior ciliary nerve and arteries located in the suprachoroid, divide superior from inferior retina. These structures travel from the equator to the ora serrata and the arteries are often seen as yellowish streaks with pigmented borders.

Peripheral Retina

The peripheral retina gradually thins with loss of distinct anatomic layers as the ora serrata is approached, although the retinal pigment epithelium is continuous with the pigment epithelium of the ciliary body. Depending on the amount of pigment present in the choroidal stroma, tessellation or tigroid fundus is either light or dark.[2] Interesting as the details may be, they are just variations of normal retinal appearance. Even variation of retinal pigment within the same eye is common.

The peripheral retina is comprised of small circumferential retinal vessels that lie parallel to the ora serrata. The short ciliary arteries are more numerous and may appear in any quadrant. They are most prominent in the 6 and 12 o'clock positions.[3] The short ciliary nerves may or may not run with the arteries and will appear as yellow circular lines in the peripheral fundus. The nerves are irregular in appearance and therefore, these are not a good reference for location.

Vitreous Base

The vitreous base is an area of peripheral fundus where the vitreous, sensory retina, and pigment epithelium are all firmly adherent. Even the posterior hyaloid membrane can not detach from this area. The vitreous base extends 360 degrees approximately 2 DD posterior and 1 DD anterior to the ora serrata.[4]

Ora Serrata

The ora serrata forms the juncture of sensory retina and the pars plana. The ora is usually darker than the retina and not uniform by having scalloped borders and mottled appearance mostly in the supero-nasal quadrant. This is most likely due to the fact the ora serrata lies closer to the limbus nasally than temporally. A landmark of the scleral location of the ora is the insertion of the medial rectus muscle nasally and the lateral rectus muscle temporally. At the ora, the retina is firmly adherent to the choroid, which is responsible for the fact that a retinal detachment of the retina ends here (where the ciliary body is the narrowest).

The ora is composed of "teeth" or dentate processes. Two adjoining dentate processes may enclose the pars plana epithelium, a pigmented brown band anterior to the ora serrata. This closure forms an oral bay and is found in 6% of the population.[5] Though many variations can be noted, the two eyes in any single individual are remarkably similar in their serrate arrangement.

Meridional Folds

Meridional folds are elevated linear retinal folds along the teeth of sensory retina. They reflect anteriorly along dentate processes to the pars plana. This white area has strong vitreoretinal adhesion with a nasal predisposition. Meridional folds are found (usually bilateral) in 26% of the population and are rarely associated with retinal breaks.[6]

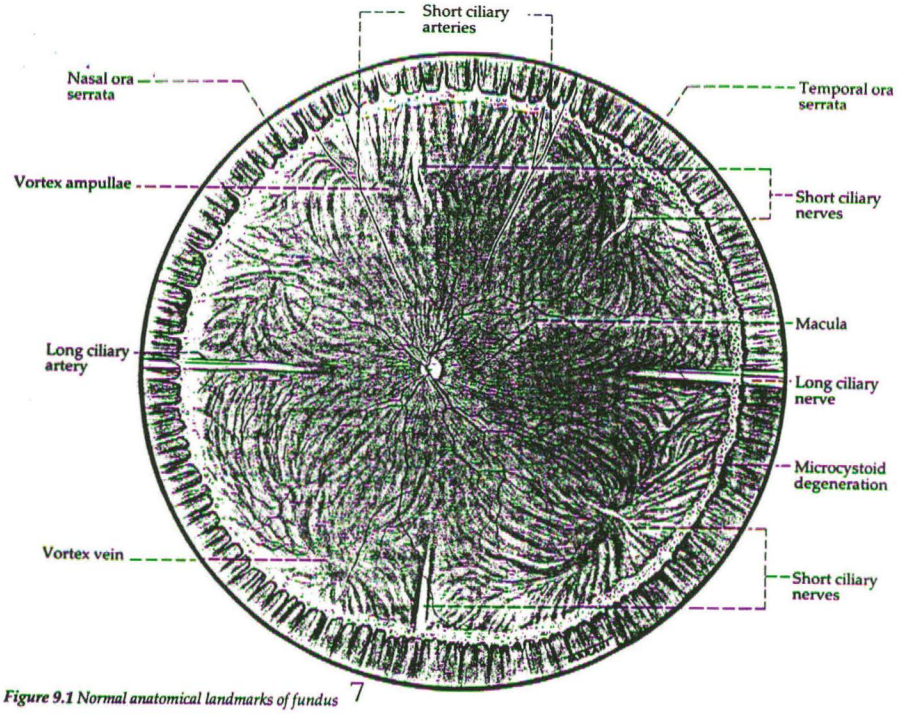


Figure 9.1 Normal anatomical landmarks of fundus [7]

Optics and Instruments

The amount of illumination and magnification, field of view, along with the knowledge of what region is to be observed can play a role in the examiner's interpretation and clinical judgement of the retina, It is important to recognize the various types of lenses, scleral depressors, etc. for observation of the vitreous and retina and be able to understand how each instrument can be employed with the optical principles involved. Each instrument has unique characteristics and therefore, can be utilized differently depending upon the intent of the examination.

Binocular Indirect Ophthalmoscope

Learning to use an indirect ophthalmoscope takes practice and determination, but it results in better diagnosis and patient care. The binocular indirect ophthalmoscopic device is in the form of a head-mounted mirror/lens system capable of producing high illumination from a controllable rheostat located on a separate light source.

Spectacle-mounted systems are also available. The resolution of the binocular indirect ophthalmoscope is directly proportional to illumination and the available 7.5 volts of the indirect allows for a clear image peripherally.[8] A 20D condensing lens is routinely used giving approximately 3.5X magnification. If difficulty viewing the ora serrata is encountered, lenses other than the standard +20D lens can be used. A 28D or 30D lens, along with the new Volk 2.2 Panretinal lens will provide less magnification but give a broader field of view.[9] These lenses may unfortunately not work well on all patients. A simple equation to allow the examiner a quick check on the amount of magnification given by a certain lens is 60D/ power of lens = magnification.[10] For example, 60D/ 20D condensing lens equals 3X magnification.

Goldmann Three-Mirror Lens

Another technique, not so routinely utilized as the binocular indirect ophthalmoscope, is biomicroscopy with the Goldmann three-mirror lens and/or Volk Quadraspheric lens. The Goldmann lens is a black plastic cone-shaped device with a concave surface. The lens has a central -64D lens for viewing the posterior pole or central 30 degrees of retina.[11] Three mirrors surrounding the central lens are set each at different angles to view the entire retina and anterior chamber angle. The largest equatorial mirror enables visualization from the 30 degrees up to the equator. The peripheral mirror allows for viewing between the equator and ora serrata and is medium in size relative to the three mirrors. The smallest, D-shaped mirror, is for gonioscopy and examines the extreme periphery. The amount of slant in each mirror can be a clue to what areas will be seen. For example, the greater the mirror is angled the further anterior it will reach.

The Quadraspheric lens by Volk is an ultra wide field design that uses an approximately +100D condensing lens that is similar to the classical Goldmann three-mirror lens, although its tube length is shorter and it has a knurled outer rim.[12] Both the condensing lens and the contact lens components are double aspheric surfaces. This lens provides the examiner with a very large field of view of approximately 125 degrees.

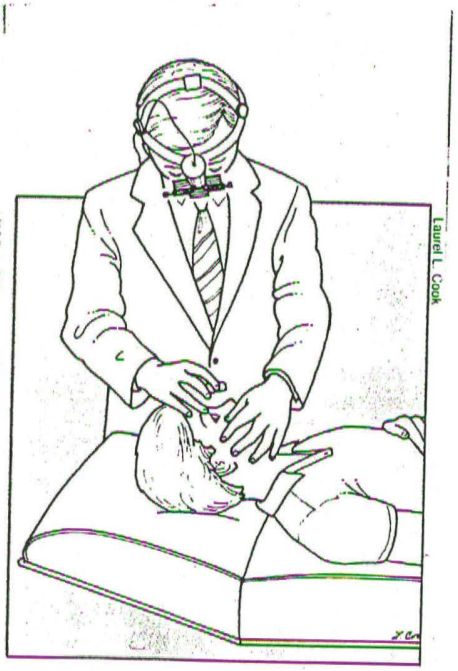
Scleral Indentation

The tools needed to perform scleral indentation are a binocular indirect ophthalmoscope, condensing lens, and something to indent the sclera and globe. Cotton swabs, pencils, and coins have been reportedly used. Correctly, a scleral depressor chosen by the examiner should depend on what area or abnormality requires evaluation and individual preferences based on hand size, dexterity, and coordination.

Most doctors prefer the standard thimble-shaped, stainless steel indentor with a fixed, slightly curved shaft protruding from the end.[13] This type of probe can be positioned lower on the finger and is shorter and more broadly knobbed. A Mainster S-type of indentor is shaped like a pen and can be more delicately applied. It may be easier to manipulate for smaller hands and is helpful with patients with recessed orbits and allows for plenty of room for fingers.

The condensing lenses chosen will vary based on whether or not a larger field of view is desired or if there is ample room in front of the patient's eyes for manipulation of an indentor in one hand and condensing lens in the other.

Binocular Indirect Ophthalmoscopy, Goldmann Three-Mirror Lens, and Scleral Indentation



Binocular Indirect Ophthalmoscopy-Head-mounted light source and condensing lens.

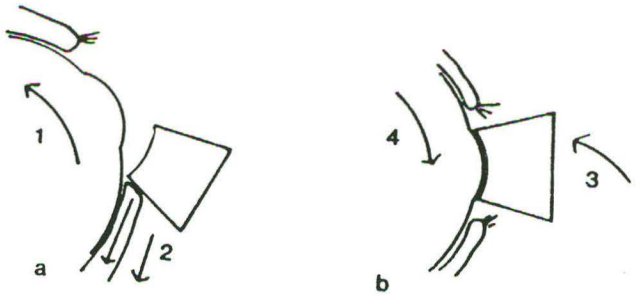


Figure 5: Insertion of a Goldmann 3-mirror fundus contact lens. A: Patient is instructed to look up and lower lid is retracted by pressure from lens. B: Lens is rocked upward into contact with eye and patient is instructed to look straight ahead.

Goldmann Three-Mirror Lens

Volk Quadraspheric Lens

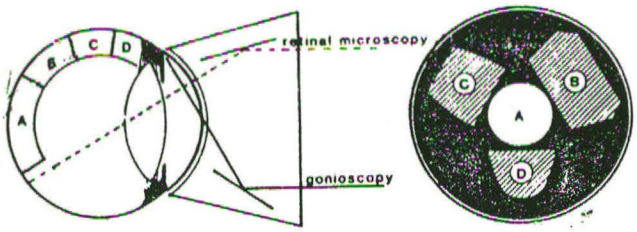


Figure 7: Proper use of central optical zone and mirrors of the Goldmann 3-mirror lens.

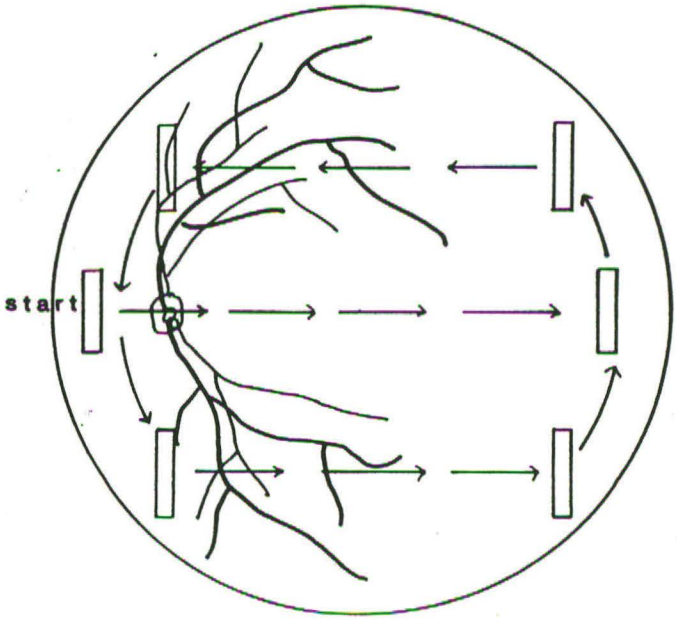
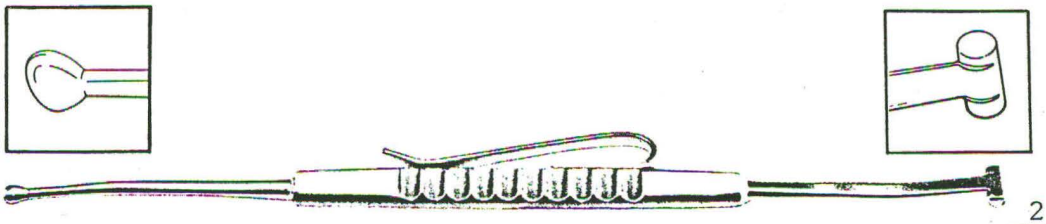


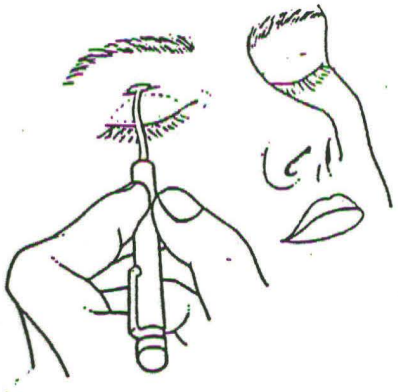
Figure 4: Recommended scanning procedure with the Volk Quadraspheric Lens. (from Barker RM. Vitreoretinal biomicroscophy. J Am Optom Assoc 1987; 58:985–992).

Two Styles of Scleral Depressors

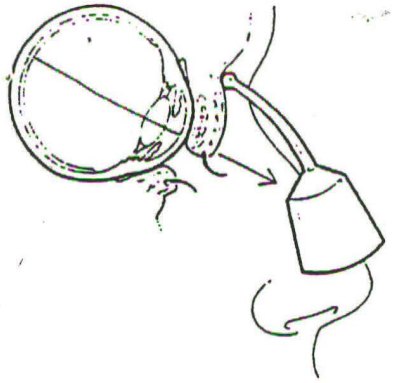
1.

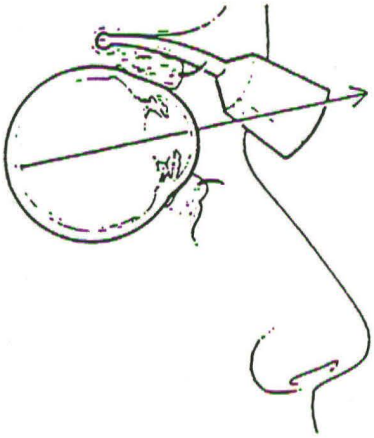


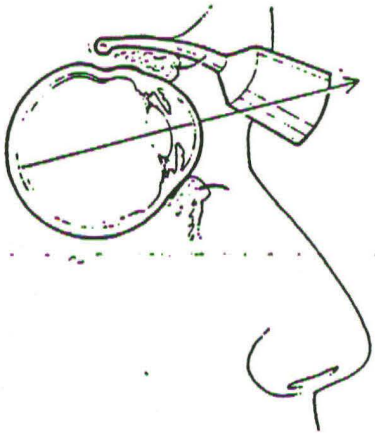
2.



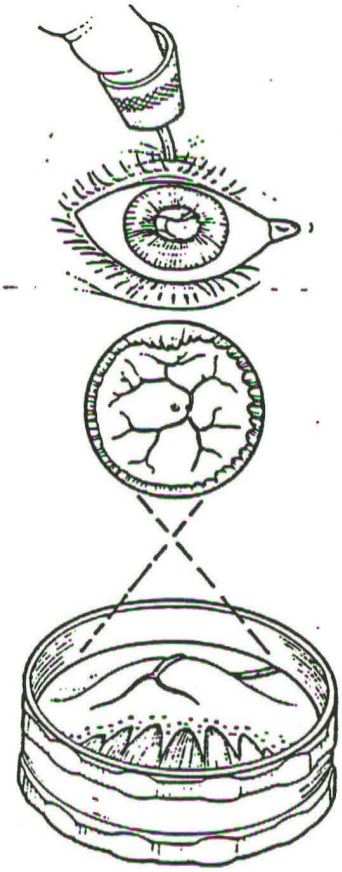
Insert the indentor into the superior lid fold and move back as the lid retracts. Stay in the superior tarsal margin.



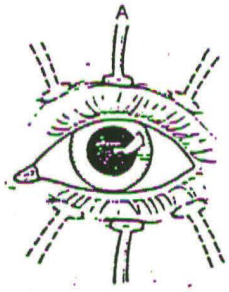


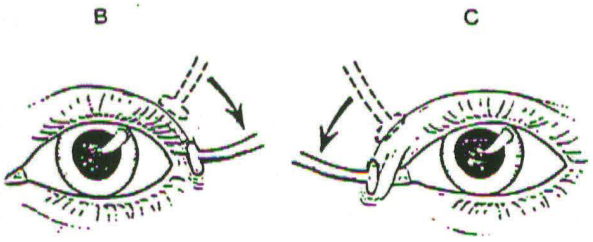


Insert the indentor into the superior lid fold and move back as the lid retracts. Stay in the superior tarsal margin.

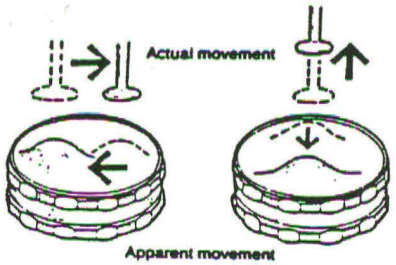


Move the indentor slightly forward and back to examine the far periphery and ora serrata.





To see the nasal and temporal sides, drag or hook the upper lid and gently pull it to the area you want to examine.



The actual movement of the indentor is reversed in the lens.

Diagnostic Drugs and Dilation

If the eye does not have a dilated pupil, it is impossible for the equator, peripheral retina, and ora serrata to be examined with any of these instruments. Even when dilated maximally, the iris can conceal the anterior retina and despite all efforts, some areas cannot be adequately viewed.[14] To dilate the eyes, optometrists use diagnostic drugs such as tropicamide and phenylephrine. Great care should be taken to avoid complications that may arise such as closing an angle or causing adverse systemic effects.

Drops	*Approximate Maximum Effect*	*Approximate Duration of Action*
MYDRIATIC:		
Phenylephrine 2.5, 10%	20 minutes	3 hours
CYCLOPLEGIC/MYDRIATIC:		
Tropicamide 0.5, 1%	20-30 minutes	3-6 hours
Cyclopentolate 0.5, 1, 2%	20-45 minutes	24 hours
Homatropine 2, 5%	20-90 minutes	2-3 days
Scopolamine 0.25%	20-45 minutes	4-7 days
Atropine 0.5, 1, 2%	30-40 minutes	1-2 weeks

The usual regimen for a dilated examination is:

Adults Phenylephrine 2.5% and tropicamide 1%. Repeat these drops in 15-30 minutes if the eye is not dilated.

Children Phenylephrine 2.5%, tropicamide 1%, and cyclopentolate 1-2%. Repeat these drops in 25-35 minutes if the eye is not dilated.

Infants Phenylephrine 2.5% and tropicamide 0.5%. Homatropine 2% or cyclopentolate 0.5% (generally reserved for infants more than 1-2 months of age) may also be used. The drops can be repeated in 35-45 minutes if the eye is not dilated. [15]

Remember these notes:

1) Darkly pigmented eyes may not dilate as effectively as lighter colored eyes and may require stronger acting drops or repeated instillations of drops.

2) The use of a topical anesthetic (Alcaine 1/2%, for example) administered first will enhance the penetration of the dilating drops.

3) In the hypertensive patient, the use of a short-acting mydriatic/cycloplegic drug, such as tropicamide 1% or cyclopentolate 1%, will lessen the chance of aggravating the hypertension. These drugs are safer than phenylephrine. Be sure to ask a thorough patient health history.

4) The incidence of angle closure on patients with narrow angles is fairly low.[16] Yet dilating drops are contraindicated in most types of angle closure glaucoma and in eyes with severely narrow anterior chamber angles. If an angle does close, drugs like oral Diamox and/or Osmoglyn can re-open the angles.[17] Topical agents such as Pilocarpine 2%, dapiprazole (Rev-Eyes), and 0.5% beta blockers (Betagan) are often kept in office for breaking acute angle-closure glaucoma attacks.[18]

Peripheral Degenerations and Complications

Common disorders of the peripheral retina are evaluated to determine whether the condition is benign or has the potential to cause major ocular/visual damage.

Cystoid Degeneration

The most prevalent form of retinal degeneration is cystoid degeneration. Cystoid degeneration is the permanent accumulation of cystic pockets formed by a clear material that compresses glial tissue in the outer plexiform layer.[19] The cystoid degeneration begins at the ora serrata and progresses posteriorly. It has a moth-eaten appearance- presenting itself as numerous small, white microcysts. Cystoid degeneration is present in many infants and all patients over 8 years old.[20] Patients are asymptomatic yet are considered predisposed to retinal detachments with this condition.

Reticulopigmentary Degeneration

Another benign degeneration that effects the retinal pigment epithelium, is reticulopigmentary degeneration. This phenomenon is common in myopes, fair-complected individuals, and in the periphery of elderly patients.[21] Reticulopigmentary degeneration, routinely called "honeycomb" degeneration, can appear as a diffuse retinal pigment epithelium hyperplasia change in a net-like appearance near the ora serrata.

Pavingstone (Cobblestone) Degeneration

Pavingstone degeneration is an idiopathic chorioretinal decomposition usually found in young adults and its incidence increases with age.[22] This process has a predilection for the inferior retina, often bilaterally. These lesions are near the ora and appear as punched-out chorioretinal areas with no overlying elevation. This harmless condition has pigment epithelium and outer retinal layers that are damaged or absent.[23] The lesions are well-demarcated, rounded, and pale yellow in coloring. Often, there is a rim of pigment surrounding the border. Several lesions may coalesce to form a circumferential band with a scalloped margin.

Lattice Degeneration

Lattice degeneration is a common vitreoretinal degeneration occurring in approximately 8% of the population. It is characterized by elongated, excavated depressions in the periphery. These lesions are surrounded by a distinct narrow rim which projects above the level of normal adjacent retina.[24] The vitreous is firmly adherent to this rim. Lattice degeneration is more commonly found in the vertical meridians.
Glistening white spots are common on the retinal surface, giving a snail-track appearance to some lattice areas. Sclerosed retinal vessels, that thickened where they crossed the abnormal retina, can form a lattice-type network... hence, the name.

The threat of retinal detachments has given lattice degeneration notoriety in excess of what it deserves.[25] Most people are asymptomatic, yet should be instructed on the signs and symptoms to retinal detachments. This is especially true if there has been a retinal detachment in one eye already and/or a family history or retinal detachment.

Cystic Retinal Tufts

Cystic retinal tufts are congenital focal elevated vitreoretinal lesions. These strong adhesion areas are found in 5% of the population.[26] They appear as yellow-white tufts commonly with underlying retinal pigment epithelial changes near and around the vitreous base where the vitreoretinal juncture is the strongest. These tufts are said to account for 10% of all primary rhegamatogenous retinal detachments.[27]

Retinal White With or Without Pressure

This anomaly appears as merely a translucent, grayish white retina near the ora serrata. White with pressure (induced by indenting the sclera) or white without pressure (no indention necessary) may accompany lattice degeneration and syneresis of the vitreous. White without pressure represents a stronger attachment of the vitreous to the inner table of the retina or a sign of subtle changes in the deepest layers of the retina.[28] Retinal splitting or horse-shoe tears may develop along the posterior borders of white with or without pressure, especially if there is lattice present in that eye or a retinal tear in the fellow eye, but this is highly unlikely.

Retinoschisis

Involutional (Senile) retinoschisis is the splitting of sensory retina at the outer plexiform layer or inner nuclear layer. There is a statistical preference for the inferotemporal quadrant, often bilaterally. It is found in 3.7% of the population over the age of 10 and 7% over the age of 40.[29] The outer layer of the cavity, formed by the two retinal layers splitting, is thin and immobile with a "beaten metal" appearance and can show "white with pressure". The thick external wall is often hard to see since it is next to the pigment epithelium. The retinal split may show sheathing of the retinal vessels, "snow flakes" or "frosting" on the elevated inner wall of the schisis cavity.

If the contents of the cavity leak through a hole in the outer layer, the patient becomes most predisposed to a rhegamatogenous retinal detachment. Rhegamatogenous detachment may develop when there is a hole in both walls (approximately 6% develop an outer hole and there is a 3% incidence of an inner layer break occurring).[30] This is a rare complication and the most serious consequence of degenerative retinoschisis.

The clinical characteristic of retinoschisis is a dome-shaped lesion with a smooth surface. There may be cystoid degeneration anterior to the schisis cavity.

There is always a nonpigmented convex posterior border unless associated with a retinal detachment. Yellow-white flecks may be on the surface of the retina.

Retinal Breaks- Holes and Tears

Atrophic retinal holes (without an operculum) are of unknown etiology. Retinal holes mainly result from an atrophy in localized areas of weakened retina, though. They occur as small round holes near the ora serrata, and patients are usually asymptomatic. Retinal holes are round or oval breaks that occur most often within a lattice or snail-track area, but they may occur anywhere in the posterior or peripheral retina. Holes will appear red with a possible white ring or cup (traction or fluid in subretinal space) surrounding the hole.[31]

Retinal tears, unlike retinal holes, can be the result of mechanical forces, usually vitreal traction or trauma. The distinctive feature of a retinal tear is an operculum of tissue. A retinal tear, often horse-shoe shaped, is partly covered by a "flap" of tissue. The peripheral retina is susceptible to tears due to the internal limiting membrane and the retinal parenchyma being extremely thin. Forty percent of all patients with a retinal detachment have a tear at the border of lattice degeneration[32]

Retinal Detachment

Because the photoreceptor layer of the retina is only loosely adherent to the pigment epithelium, the two layers may separate, allowing fluid to accumulate between them. The fluid usually comes from the vitreous, having passed through a hole in the retina. Rhegamatogenous (break-induced) retinal detachment is dependent on three factors; a retinal break, liquid in the vitreous, and a force to disengage the bond between retina and pigment epithelium. The vitreous supplies this force the same way it causes retinal tears through traction.

Retinal detachments can spread and detach themselves in a few hours or it may take years for this to happen. There will be a "milky-white" opalescence due to the retina being unable to rid itself of its own fluid and the sensory retina will become edematous. There will be obscuration of underlying details and an undulated surface. If the detachment is longstanding, a demarcation line of pigment epithelial disturbance may be present to separate normal from detached retina.

Patients may be asymptomatic or report photopsia (flashing lights), an increased number of floaters, and the appearance of a curtain or veil in front of their eyes.[33] If the detachment spreads slowly the patient may be unaware of any problem until the macula is involved.

Technique and Instrumentation Comparison

Binocular Indirect Ophthalmoscopy

To perform binocular indirect ophthalmoscopy, one must first know how to prepare and position the patient so that an optimal evaluation may be obtained. Following is a listing of performance techniques...

1. To begin, the patient needs to be maximally dilated as discussed earlier in the paper. Then, explain the procedure to the patient. The patient will be more at ease when knowing what to expect from binocular indirect ophthalmoscopy.

2. Some doctors prefer to recline the patient and position themselves 180 degrees from the area they wish to view.[34] Other doctors prefer to raise and lower the patient while the patient is sitting in the examination chair allowing the doctor to stand in front the patient.

3. Adjust all instruments and make sure that the filament light source is diffuse so a clear fundus image will be obtained.[35] All mirrors and condensing lenses should be free of fingerprints and dust.

4. Ask the patient to look into the position of gaze where you would like to evaluate. For example; a) begin with the patient looking up and to the right b) straight up c) up and to the left d) directly right, then directly left e) straight ahead f) down and to the right g) straight down h) down and to the left.

Getting a good view of the periphery is challenging and requires motivation and practice. Some doctors report the fundus details to be too small and there is difficulty in obtaining the ora serrata 360 degrees. Yet, one big advantage of indirect ophthalmoscopy is the ability to maintain resolution past the equator up to and including the ora. The great field of view is ideal for an overall check of the peripheral retina and this enables the examiner to see and diagnose conditions that would have been otherwise missed. Binocular indirect ophthalmoscopy is also the foundation on which scleral indentation is based.

Goldmann Three-Mirror Lens

Insertion and removal of the Goldmann contact lens and Quadraspheric lens are basically the same. The technique involves placing a few drops of gonioscopic solution (for example, Goniosol which is a hydroxypropyl methylcellulose 2.5% ophthalmic demulcent solution) in the concave portion of the lenses. The patient is seated comfortably at the biomicroscope (forehead is against the headrest and mouth is closed). The patient is to look up as the insertion of the lens into the inferior cul-de-sac is made. One may have to secure the patient's upper eyelid with a free hand.

The patient now looks straight ahead as the lens is rotated on the cornea to obtain a view of the peripheral retina. The medium sized mirror is positioned 180 degrees away from the quadrant needed to examine.

Next, position the slit lamp parallel to the mirror and focus the biomicroscope, beginning with low magnification. Examine the specified area or rotate the lens and observe each quadrant as necessary. To remove the lens, ask the patient to look nasally and place gentle pressure through the eyelids onto the temporal sclera.[36] The patient should be irrigated at this point to remove any excess gonioscopic prism solution that may remain.

Goldmann three-mirror lenses have a field of view with a virtual, erect image.[37] The surface reflections are variable and may be reduced with more correct positioning of the slit lamp beam. The use of a corneal contact lens to bring the retina into focus can be uncomfortable and intolerable to the patient. Many patients complain of the gonioscopic solution being too "messy" and many patients find it difficult to keep straight fixation while an eye is not being allowed to blink. Corneal distortions from lack of oxygen at the cornea, as reported by the patient, can also be annoying to them after the procedure is finished. These seem to make the Goldmann three-mirror lens an inconvenient procedure for routine or rapid assessment.

Some advantages to this procedure are that biomicroscopy with an auxillary lens can provide adjustable magnification, variable illumination when necessary, and photography. Goldmann three-mirror lens is considered, by some, to be the most reliable method currently available for peripheral retinal examination.

Scleral Indentation

Scleral indentation is the act of depressing the eyeball posteriorly at or near the ora serrata to bring the most anterior portions of the retina into view. In some patients the ora cannot be seen unless this technique is used.

As with standard binocular indirect ophthalmoscopy, the exam chair should be set up so that movement around the patient is uninhibited. It will be necessary to be able to switch which hand holds the indentor and which hand holds the condensing lens as the patient is examined. Have the patient look down or in the opposite direction of the area wishing to be viewed. Insert the indentor gently into the fold above the tarsal plate and tell the patient to look up towards his/her forehead. As the lid retracts, slide the indentor back into the orbit.[38] The use of an anesthetic for viewing the three- and nine o'clock positions may be necessary if the depressor needs to be placed directly on the globe.

Now, shine the light from the indirect ophthalmoscope into the pupillary area for a red reflex. Check to see if there has been a darkening of the red reflex along the pupillary axis, then insert the condensing lens.[39] There will be a grayish mound or elevation in the inferior portion of the lens and one can adjust

the probe as necessary. When wanting to view the more peripheral areas, tell the patient to look away from you. When wanting to examine the more equatorial areas, tell the patient to look toward you or the scope.[40]

Sometimes the patient may feel slightly uncomfortable by the pressure they will feel on the globe and may report a certain soreness or discomfort. The patient must also maintain a steady fixation and be extremely cooperative while performing this procedure. The greatest problem for the doctor is intially visualizing the position of the depressor. Also, it is not easy to gauge the amounts of applied pressure and it it is necessary to remember that only small amounts of pressure and movement is required for sufficient indentation. Scleral depression is contraindicated if there has been blunt trauma or if there is suspicion of ruptured globe.[41]

Scleral indentation is painless for the patient and offers the doctor a way to examine the extreme periphery of a patient's retina through movement for different views of the same lesion. With this technique, the doctor will be better able to assess whether or not the lesion is excavated or elevated. This, for example, will allow one to differentiate between a reinal break, whose margins will blanche with indentation, and a retinal hemorrhage, which remains constant in color and appearance even when indented. The procedure will not initiate or worsen retinal breaks or detachments.[42]

Clinical Importance of Scleral Indentation

Most doctors realize that scleral indentation is a valuable skill in helping to diagnose and assess the peripheral retina. The more optometrists are equipped and skilled to perform scleral depression, the better quality care our patients will receive. Scleral indentation can offer a different perspective to the retina when there is a question of urgency and/or emergency or just a necessity to label a particular finding. Scleral depression allows the retina to be viewed in profile, which can be crucial in diagnosing the depth and character of a lesion. This procedure is convenient and inexpensive for the doctor and allows the doctor to assess diagnostic data that may not have been obtained.

Thorough peripheral examination should be made of a patient who presents with a history of retinal detachment, complaints of recent onset to flashes or floaters, a traumatized eye, or high myopia, or any previously documented lattice degeneration, retinoschisis, or retinal hole. If optometrists use dilation techniques and indirect ophthalmoscopy on a routine basis, then it just goes to show that scleral indentation should become the next step in peripheral retinal evaluation and doctors should at least continue to keep themselves active in practicing their techniques.

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Appendix A

*** Results of Survey ***

Thirty patients ranging from age thirteen to forty-seven, with an average age of twenty-six, were examined by the three techniques discussed in this paper. Eighteen males and twelve females were evaluated. Each patient had a known peripheral retinal finding whether it was benign or abnormal, and all were considered systemically healthy. The patient was then asked to complete a questionnaire pertaining to each technique and therefore, subjective data was obtained. The procedures were as follows: Binocular Indirect Ophthalmoscopy, Goldmann Three-mirror Lens, and Scleral Indentation.

Question 1

a.) Scleral Indentation... yes-12 no-18
b.) Three-Mirror Fundus Lens... yes-21 no-9
c.) Binocular Indirect Ophthalmoscopy... yes-8 no-22

The patients that answered "yes" to a.) reported that the feeling of "pressure" where there normally is no pressure was unusual and somewhat disturbing. None of the patients reported any "pain" was involved, just a preference for the procedure to be over with quickly.

The patients that answered "yes" to b.) recorded that the procedure was uncomfortable due to the gel needed for corneal contact. Patients felt this was "messy" and "inconvenient". Several patients felt that having to be seated at the biomicroscope was uncomfortable and that it was difficult for them to remain centrally fixated. One patient noted that he was nervous to have the doctor working so closely to his eye and disliked having the lens directly on his cornea.

The patients that answered "yes" to c.) felt that the intensity of the light source was the main problem for feeling anxious and uncomfortable. Certain patients tended to shy away from the brightness of the light and seemed very photosensitive.

Question 2

a.) Scleral Indentation... yes-5 no-15
b.) Three-Mirror Fundus Lens... yes-25 no-5
c.) Binocular Indirect Ophthalmoscopy... yes-28 no-2

Patients reporting "yes" to a.) referred to the side effects as "heavy" and "sore" eyelids but the effects did not last very long, only a few minutes (they also reported seeing the residual lights of the binocular indirect ophthalmoscopy).

The patients that answered "yes" to b.) stated that the eye felt "sore" and "burned". Patients reported corneal distortion and blurring of objects and that their eyes felt "tired" and "fatigued".

Patients that answered "yes" to c.) noted the spots and colors before their eyes as being "bothersome" until their eyes could recover from the bright intensity of the light source.

Question 3

a.) Scleral Indentation... yes-28 no-2
b.) Three-Mirror Fundus Lens... yes-0 no-30
c.) Binocular Indirect Ophthalmoscopy... yes-28 no-2

Question 4

All thirty patients preferred binocular indirect ophthalmoscopy alone, without scleral depression if given the choice. Answer c

Question 5

All thirty patients chose binocular indirect opthalmoscopy as the most "comfortable". Answer c

Question 6

All thirty patients chose Goldmann three-mirror lens evaluation as the most "uncomfortable". Answer b

Question 7

None of the patients reported to have experienced any side effects from the diagnostic dilating drops.

Question 8

27 out of 30 reported Most c
a
Least b

3 out of 30 reported Most a
c
Least b

The three patients that chose scleral indentation as the most tolerable procedure stated that it was due to not ever having to look directly at a light, they were always gazing away from the light source.

Question 9

All patients reported that they felt the procedures were explained and detailed for them enough to understand the reasoning behind having such a procedure performed. All patients reported that their feelings of comfort and well-being were taken into account.

Comments

Some of the additional comments written by the patients included statements like "I felt the procedure was going to be worse than what it was" and that to use techniques like scleral indentation and Goldmann three-mirror were more "beneficial than strictly binocular indirect ophthalmoscopy" in their opinions.

Appendix B

Patient Questionaire

1. Did you consider the procedure painful or uncomfortable?

   a.) Scleral Indentation... yes or no

   b.) Three-Mirror Fundus Lens... yes or no

   c.) Binocular Indirect Ophthalmoscopy... yes or no

   If so; why?

2. Did you experience any side effects(ex. soreness or discomfort) that you relate to the procedure?

   a.) Scleral Indentation... yes or no

   b.) Three-Mirror Fundus Lens... yes or no

   c.) Binocular Indirect Ophthalmoscopy... yes or no

   If answered yes; specifically, what were they?

3. Would you accept the procedure as routine if the optometrist felt it was necessary?

   a.) Scleral Indentation... yes or no

   b.) Three-Mirror Fundus Lens... yes or no

   c.) Binocular Indirect Ophthalmoscopy... yes or no

4. Which procedure did you prefer? a b c

5. Which procedure was the most "comfortable"? a b c

6. Which procedure was the most "uncomfortable"? a b c

7. Did you have any reactions to the dilation drops used? yes or no

8. Please list in order which procedure was the most tolerable...

   Most_____ Procedures: a b c

   _____

   Least_____

9. Did you feel your comfort and well-being were taken into account by the optometrist as each procedure was performed? yes or no

Comments: