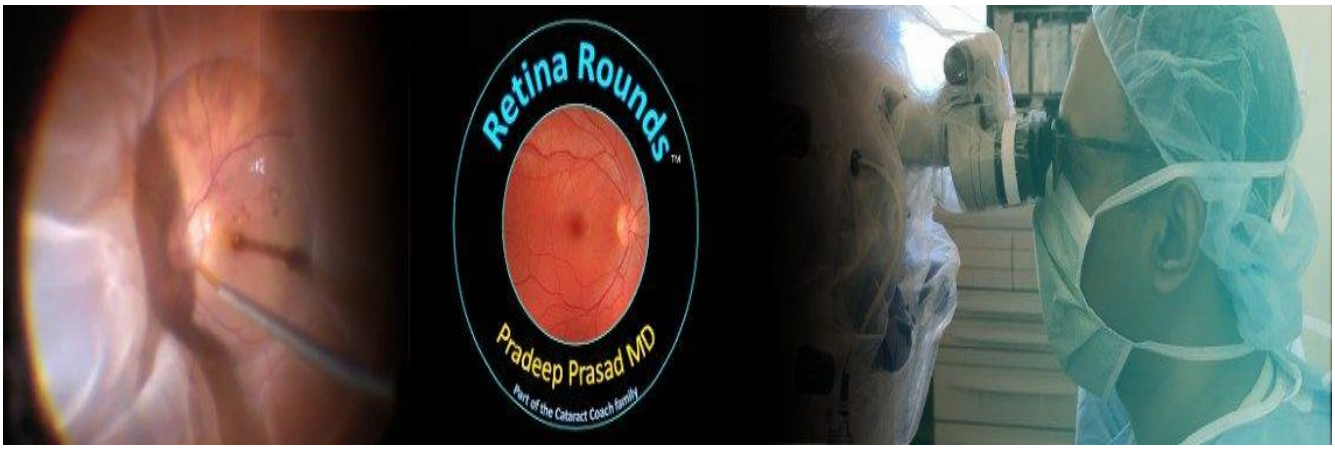
Retina Rounds

Key Lessons for Vitreoretinal Fellowship

Basic Foundational Notes to Operate Vitreoretinal Surgery

https://retinarounds.com/



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In the next few slides:

You won’t be learning anything just yet, and that’s perfectly fine.

Think of this as your brief intermission before the real journey begins.

Flip through, breathe deeply, get comfortable.

Maybe grab a coffee.

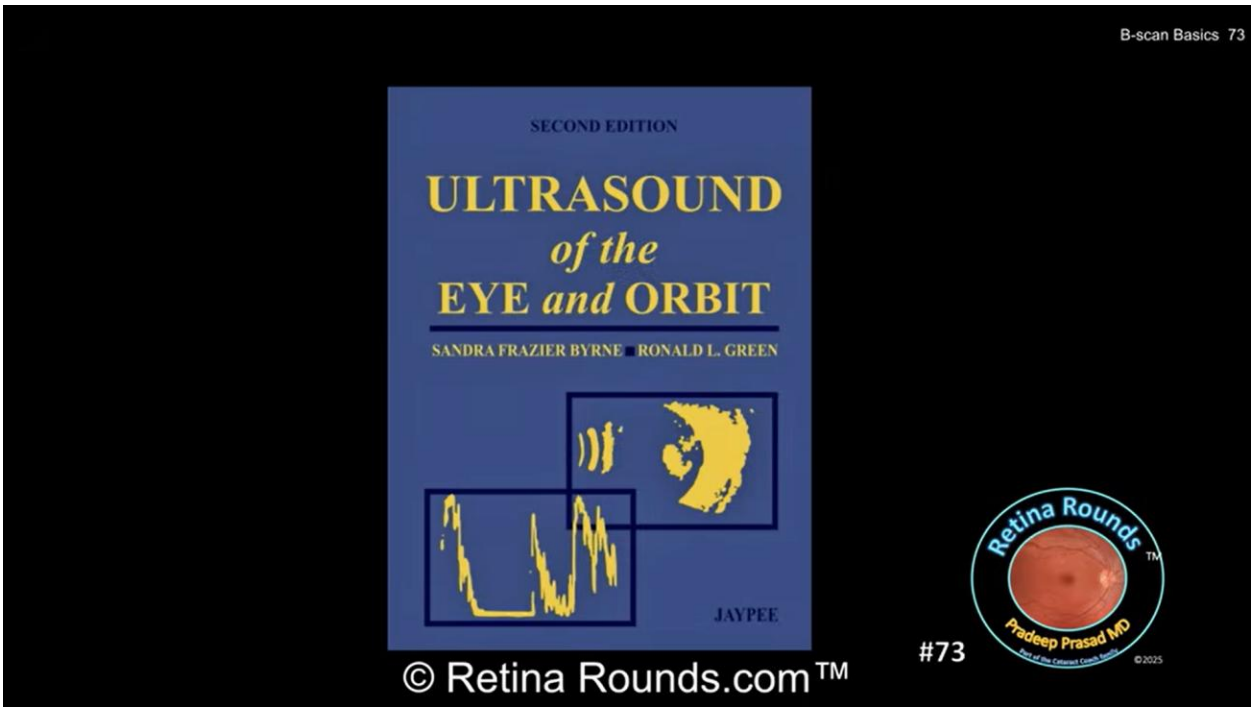
Then let’s dive in.

❖ **Vitreoretinal Basics**

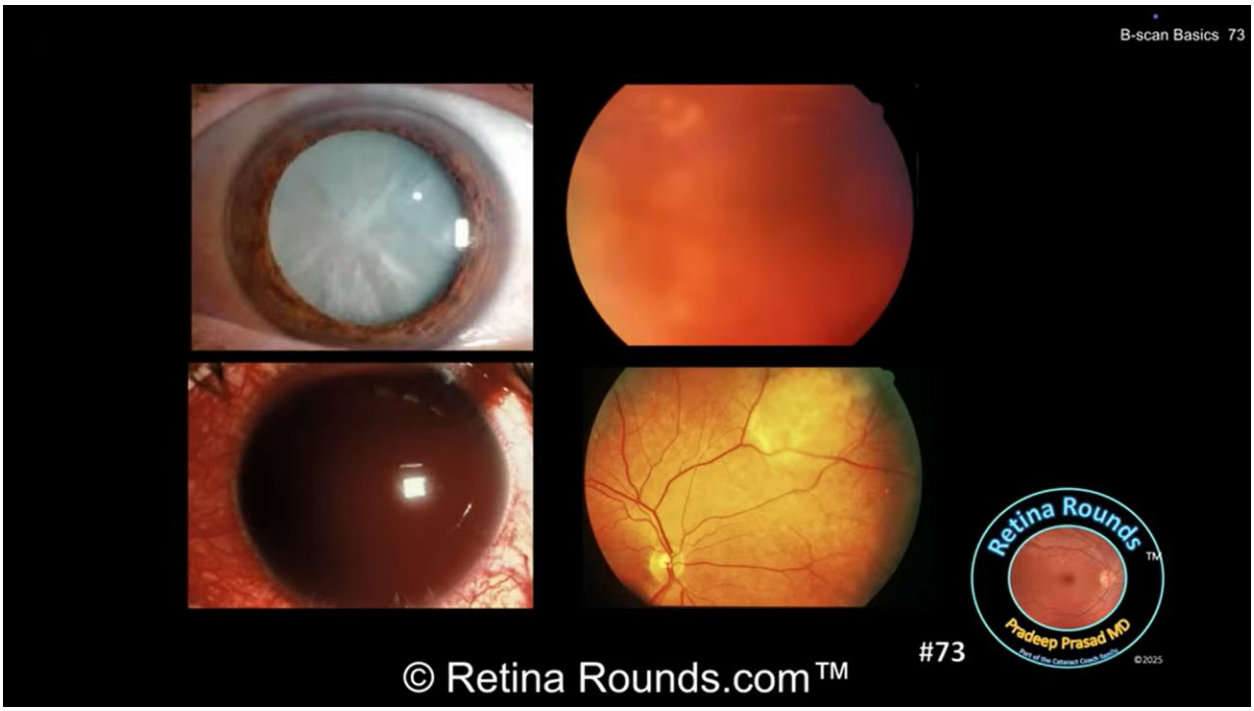
- **B-scan Basics**

Link: https://www.youtube.com/watch?v=prtGck_NyGg

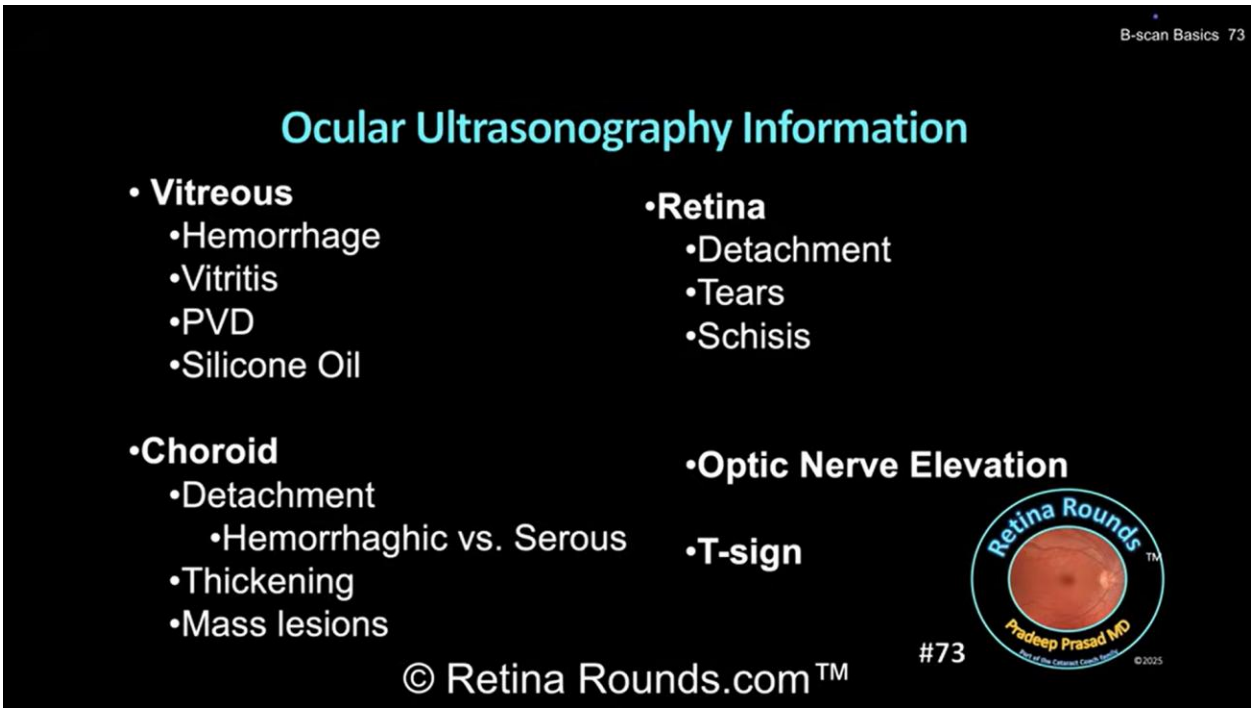
Understanding how to perform and document an ocular ultrasound is a valuable skill every ophthalmologist should have. Today we will discuss some of the basics of how to perform a screening ophthalmic ultrasound. I'd like to give a special acknowledgement to one of my former colleagues at Harbor-UCLA medical center, Dr. Ronald Green. Dr. Green taught me a great deal about ultrasonography and many of the images I present were shared with me by Dr. Green. For those you who are interested in learning more, I would highly encourage reading "Ultrasound of the Eye and Orbit" written by Drs. Byrne and Green



There are a number of reasons why of ophthalmologists may need to perform an ocular ultrasound. In some cases where there is a view to the fundus, the ultrasound is one tool in a multimodal imaging strategy to gain more information about a lesion such as a choroidal tumor or other ocular pathology to aid in diagnosis and management. In other cases, the view to the posterior pole may be obscured by a medial opacity such as a dense cataract, hyphema or vitritis hemorrhage and a screening ultrasound is performed to gain understanding of the posterior segment anatomy and to rule out vision threatening pathology.

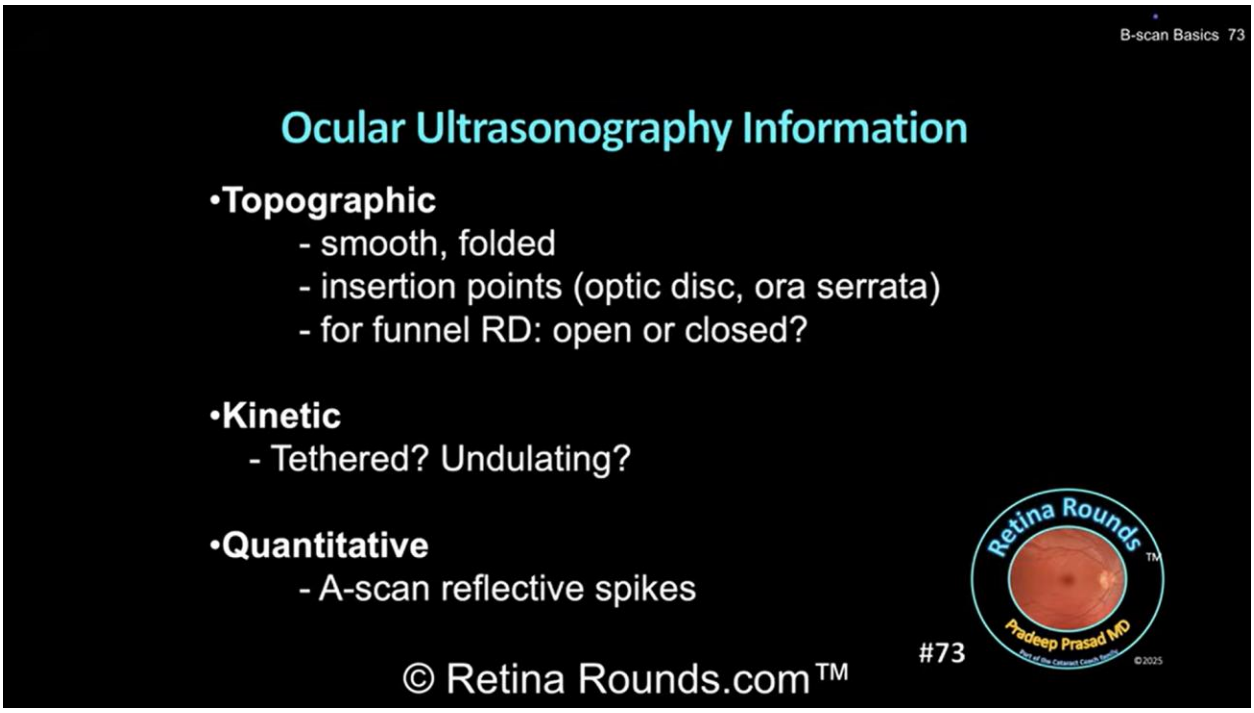


Ocular ultrasonography is a low-cost and efficient way for ophthalmologists to visualize various ocular structures. With respect to the vitreous, ultrasound can help to identify vitreous hemorrhage and vitritis, both of which may appear as punctate or diffuse hyperechoic densities.

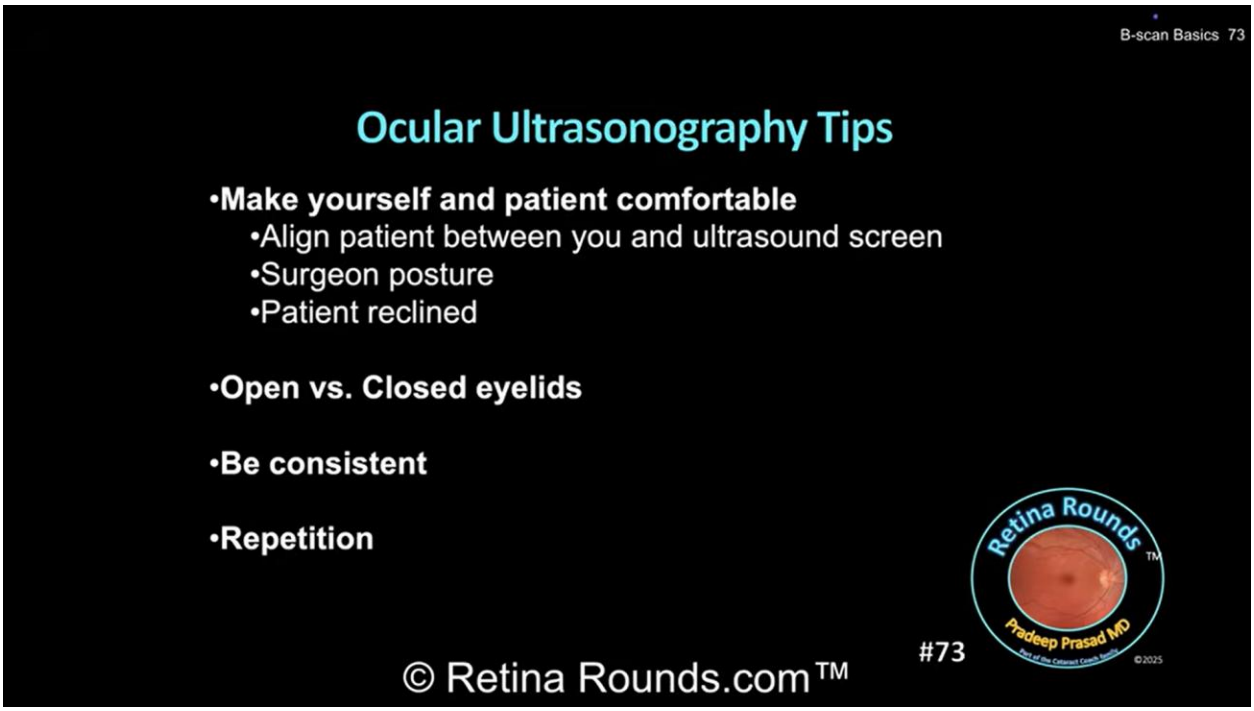


The retina can be visualized even in a silicone oil filled eye unlike a gas or air-filled eye. Although the image quality may be degraded and there will be an artifactual elongation of the eye on the ultrasound images due to the slower speed that ultrasound passes through oil versus vitreous.

Ultrasonography is often used to identify retinal pathology such as a retinal detachment or even a retinal tear, choroidal pathology such as a choroidal detachment, choroidal thickening that may be seen in uveitic or infiltrative diseases, choroidal mass lesions. Ultrasound can also be used to identify optic nerve elevation and can be useful in patients with posterior scleritis to visualize the so-called T- sign where a thin layer of fluid can be seen between the sclera and tenon capsule which when visualized proximal to the hypoechoic path of the optic nerve can give the appearance of a T.



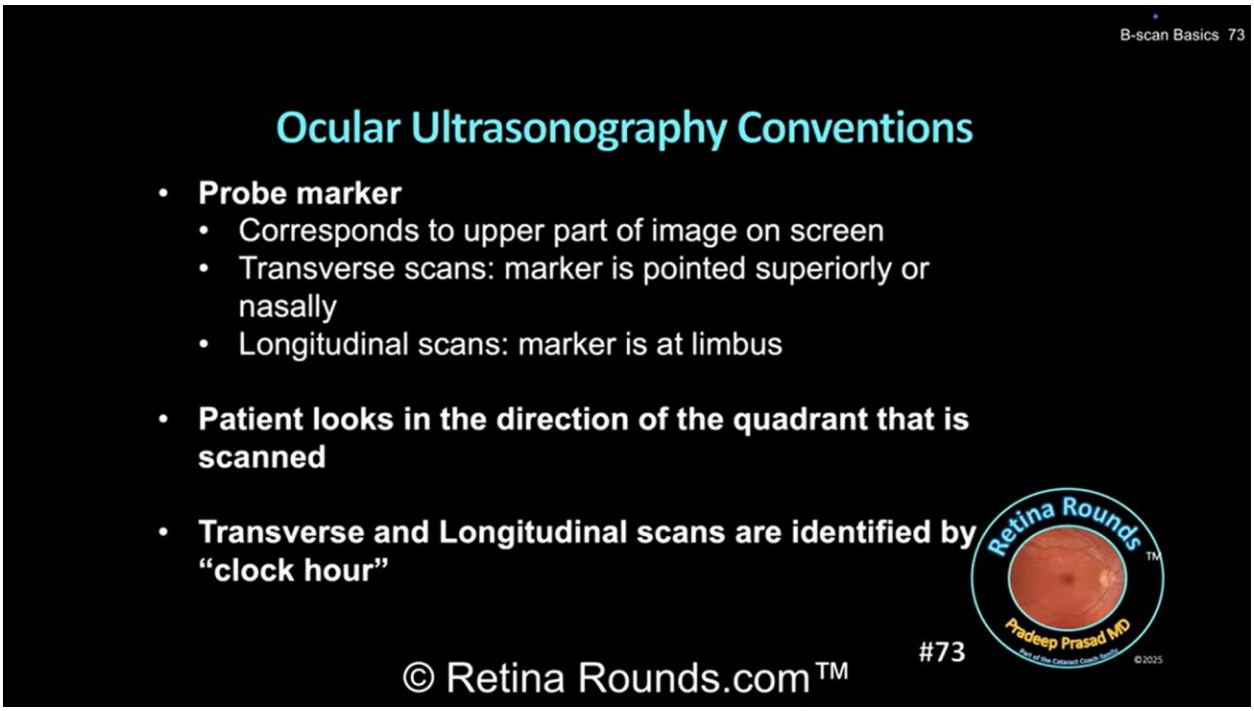
The ultrasound can give topographic information. For example, is the membrane smooth or folded? Does it insert at the optic disc and ora serrata as would be expected with retina, if the retina is completely detached, is it an open or a closed funnel configuration, etc. Ultrasonography can also be a dynamic exam with a patient moving their eyes. The ultrasound can provide kinetic information. For example, is the membrane tethered at the optic nerve as would be expected with retina or does it move in an undulating pattern as would be expected with vitreous. Lastly, the A scan function can give quantitative information about a membrane or lesion with the reflective spikes assisting with differentiation of retina from other structures.



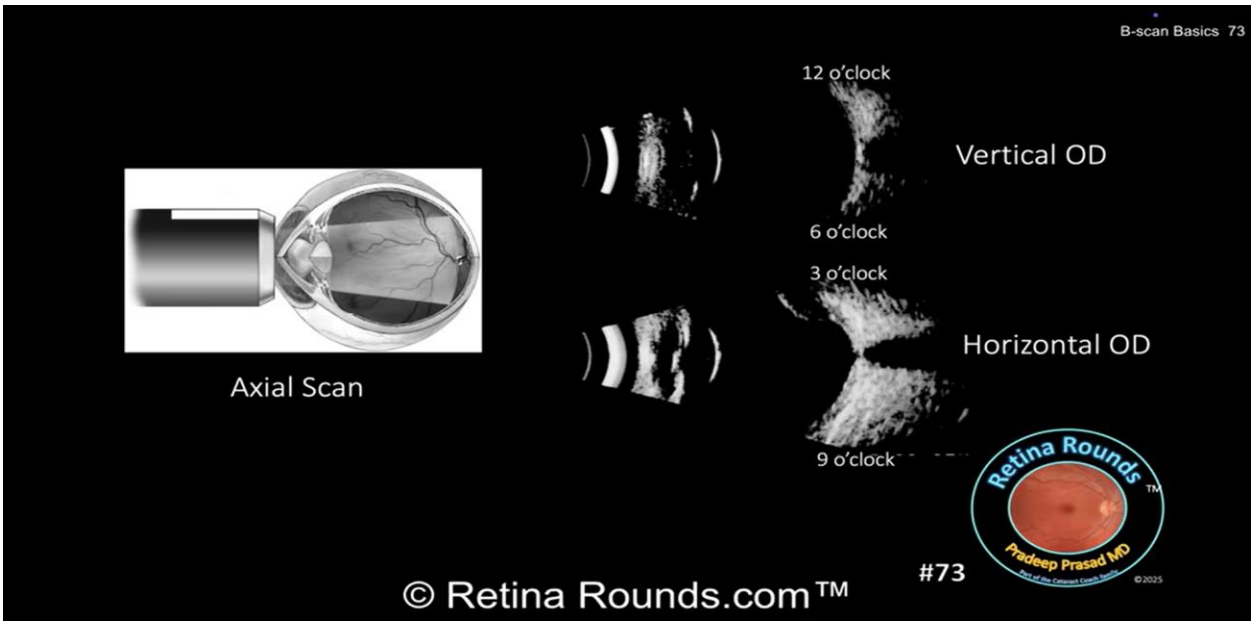
It's important to make yourself and your patient comfortable. Ideally, you should align the patient between yourself and the ultrasound screen. Your head, patient's head, and the ultrasound screen should be in roughly the same path since this will allow you to simultaneously see the monitor and your patient to visually confirm that their eye is pointed in the right direction and that your probe is properly oriented. Make sure to pay attention to your posture, avoiding hunching over the patient or having to crane your neck to see the screen. Your back and your neck will thank you later. Generally having the patient recline for this test is easiest way to position the probe and visualize a monitor at the same time. Ultrasonography should be performed with a gel-based coupling agent and can be performed through a closed eyelid or on the ocular surface with the eyelid open. The latter provides better image quality, but the eye must be anesthetized and a coupling agent that is safe for the ocular surface should be used such as a viscous ocular lubricating gel. When performing a screening examination, my recommendation is to do it the same way every time to make sure that nothing is missed. And lastly, remember that ultrasound sweeps to give you a two-dimensional image. The orientation of that image will be based on the orientation of the probe marker and the position of the probe on the ocular surface. When performing an ultrasound, you should perform multiple views with multiple orientations in order to be able to mentally reconstruct a 3D image based on the many 2D images that are required. Confidence with this, takes time and repetition. You may even need to watch this video multiple times before the concepts start to make sense. Don't worry, this is normal and with increased reps, these concepts will become second nature.

Here are three basic orientations of the ultrasound probe. An axial scan is where the patient is looking straight ahead and the probe is over the cornea. This gives you a view to the posterior pole. A transverse scan is where the patient is looking in a particular direction and a probe is placed on the sclera in the opposite quadrant with a probe marker and the path of the ultrasound sweeps parallel to the limbus. This gives a view across multiple clock hours. You can think of this scan kind of like the latitude lines on a globe. A longitudinal scan is where the patient is looking in a particular direction and the probe is placed with the probe marker at the limbus pointed in the same direction as the gaze of the patient. This gives an anteroposterior view in a single clock hour. You can think of the scan like longitude lines on a globe.

There are a few ocular ultrasonography conventions that you should be aware of. The probe marker defines the sweeping motion of the probe and the location of the marker corresponds to the upper part of the image on the screen. So, for transverse scans, the marker is oriented superiorly or nasally. For longitudinal scans, the marker is at the limbus. Patients should look in the direction of the quadrant or clock hour that is being scanned.



A vertical axial scan is where the probe marker is at 12:00. A horizontal axial scan is where the probe is pointed to the nose. If you look at the vertical axial B scan, you'll notice that the optic nerve is in the middle of the image and is hypoechoic. The upper part of the image corresponds to 12:00 and the bottom part of the image corresponds to 6:00. For the horizontal B scan, you will again see the hypoechoic nerve in the middle. Since this is the right eye with the marker pointed to the nose, the upper part of the scan image corresponds to 3:00 while the bottom part of the scan image corresponds to 9:00. Since this is the right eye, the macula will be in between the optic nerve and the periphery at 9:00. Therefore, the macula is inferior to the optic nerve shadow on this B scan image.




B-scan Basics 73
Horizontal Axial Scan
Vertical Axial Scan
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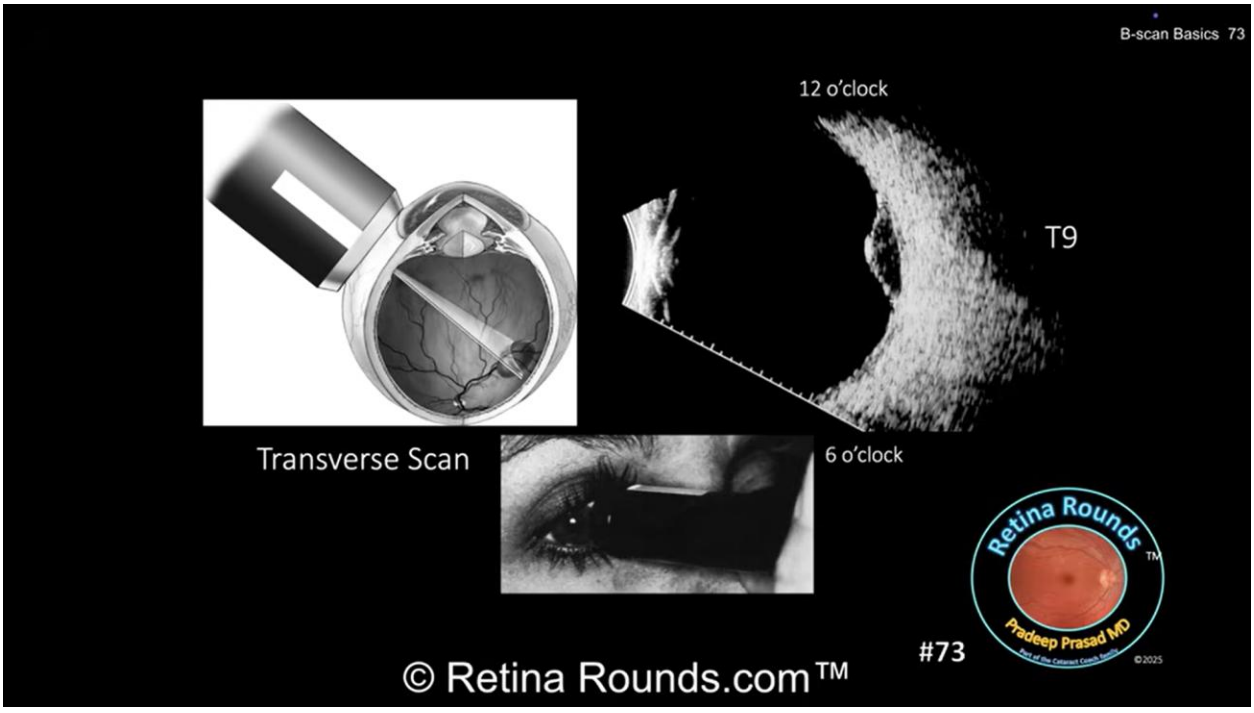
B-scan Basics 73
12 o'clock
T9
Transverse Scan
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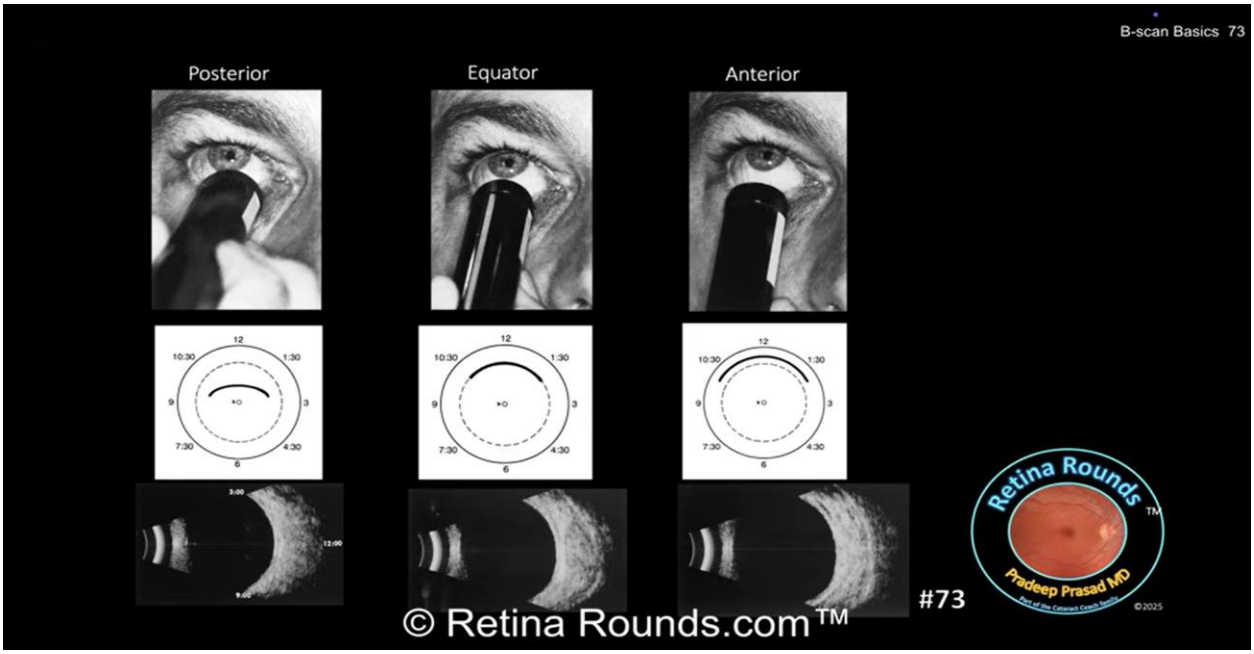
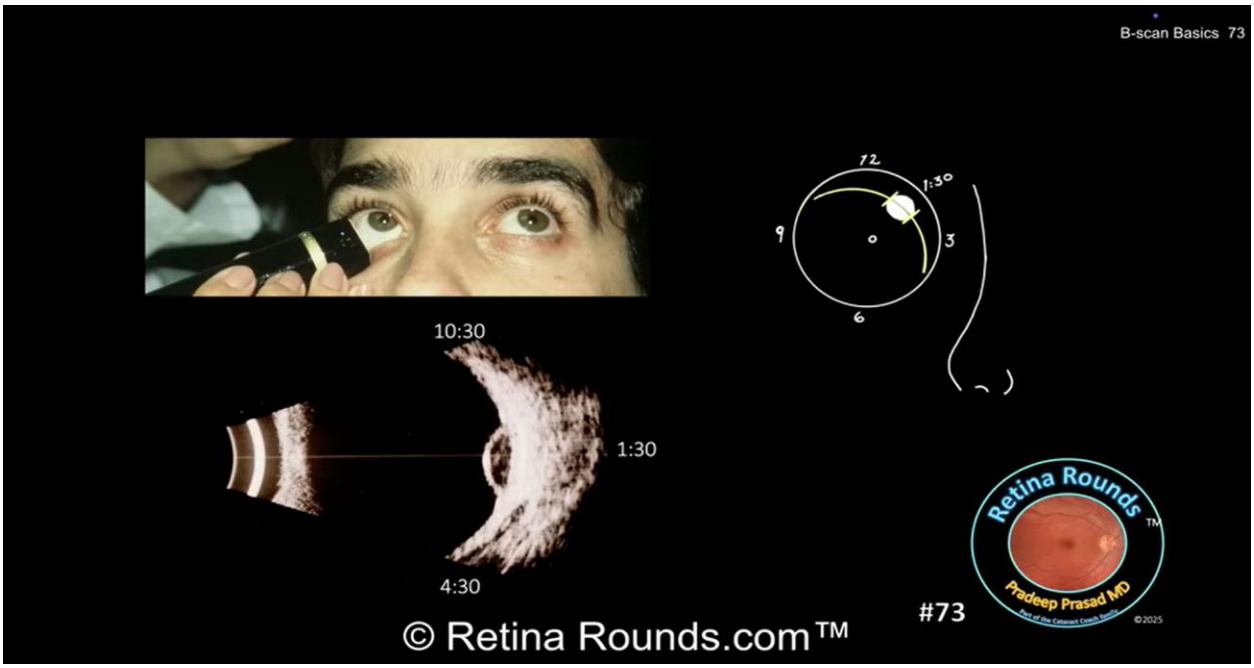
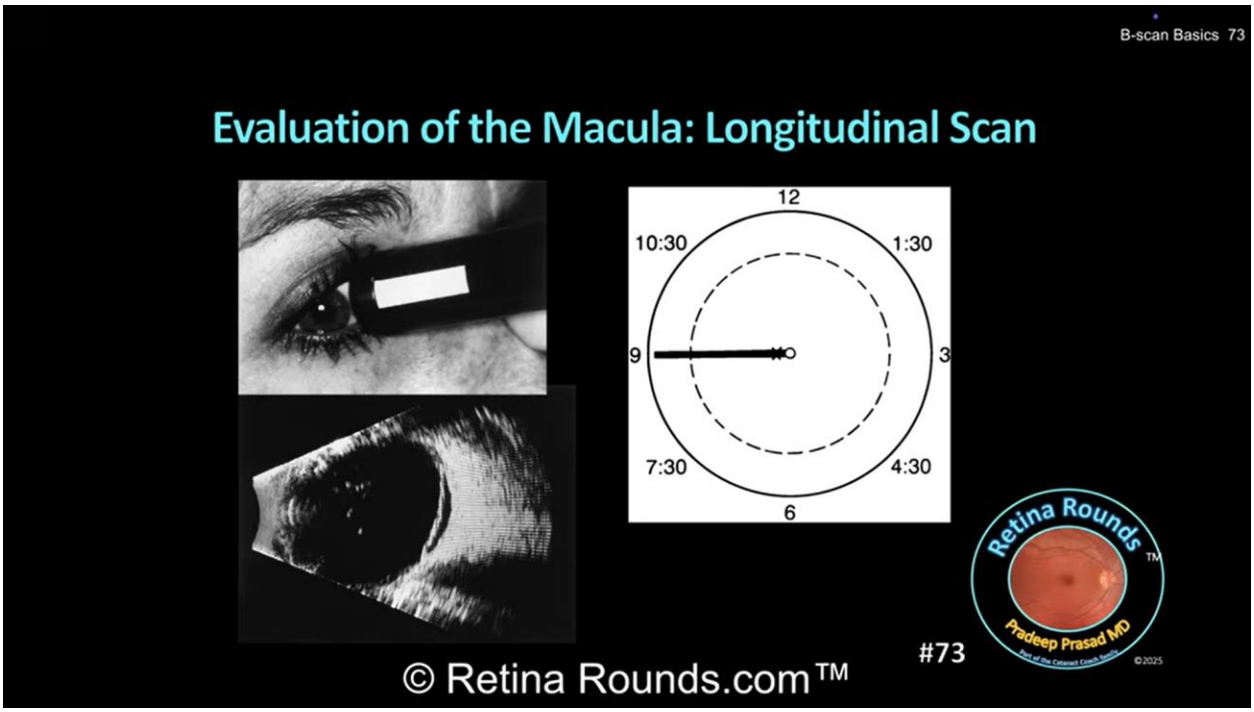


One thing to note with transverse scans is that you are looking at multiple clock hours at the same time. By tilting the probe, however, you can get uh information either posteriorly or anteriorly. All of these images are transverse scans at 12:00. The patient is looking up at 12:00. The probe is placed on the sclera in the opposite quadrant and the scanning path is parallel to the limbus with a marker pointed to the nose. The image on the left has the probe pointed more to the posterior pole to get a posterior transverse scan at 12:00 or a posterior T12. The middle image is pointed towards the equator and the image to the right has a probe angled more anteriorly or an anterior T12 image. When performing transverse scans, it's helpful to sweep the probe anteriorly and posteriorly, not only to see multiple quadrants, but also to see if the pathology is present anteriorly, equatorially, or posteriorly.

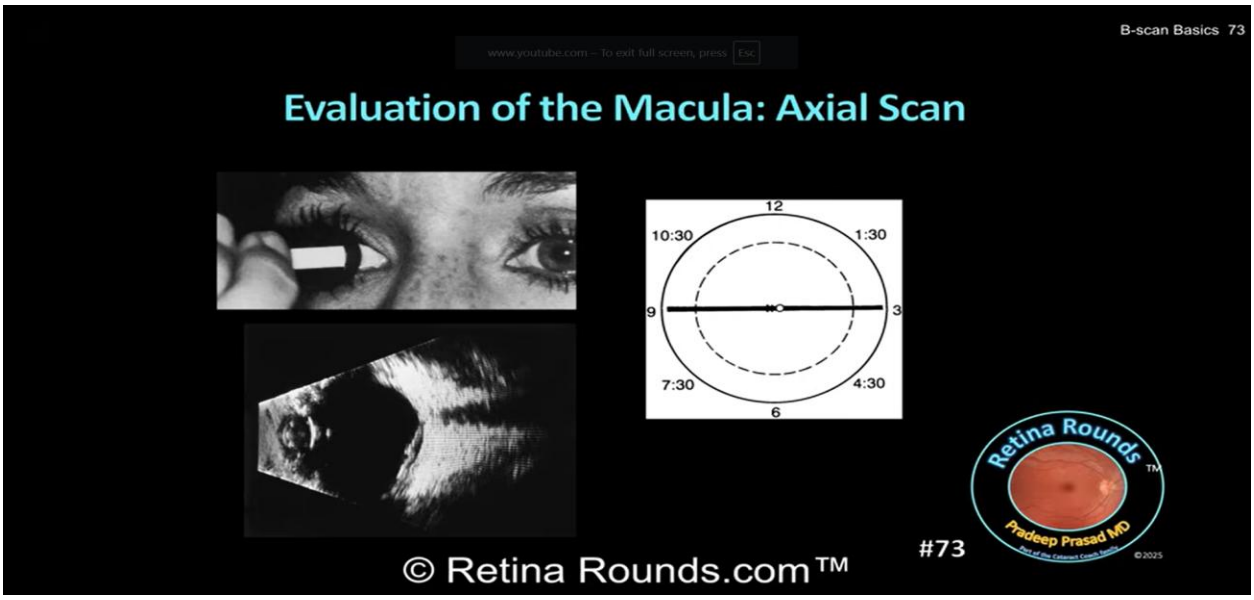
Here's a longitudinal scan. The patient's eye is pointed in a desired direction and the probe is placed on the sclera with a marker pointed towards the limbus. This scan provides anteroposterior information from the optic nerve to the periphery in a single clock hour. In the example shown here, the patient's right eye is imaged with the patient looking to the right or at 9:00. The probe is placed on the sclera in the opposite quadrant with the probe marker at the limbus also pointing at 9:00. The B scan image is an L9 image with the optic nerve at the bottom of the image and the anterior retina at 9:00. You can see that there is a mass lesion that's present. And given that this lesion is between the optic nerve and the anterior periphery at 9:00, this indicates that the lesion is in or proximal to the macula since the scanning path from the optic nerve to the temporal periphery goes right through the macula.





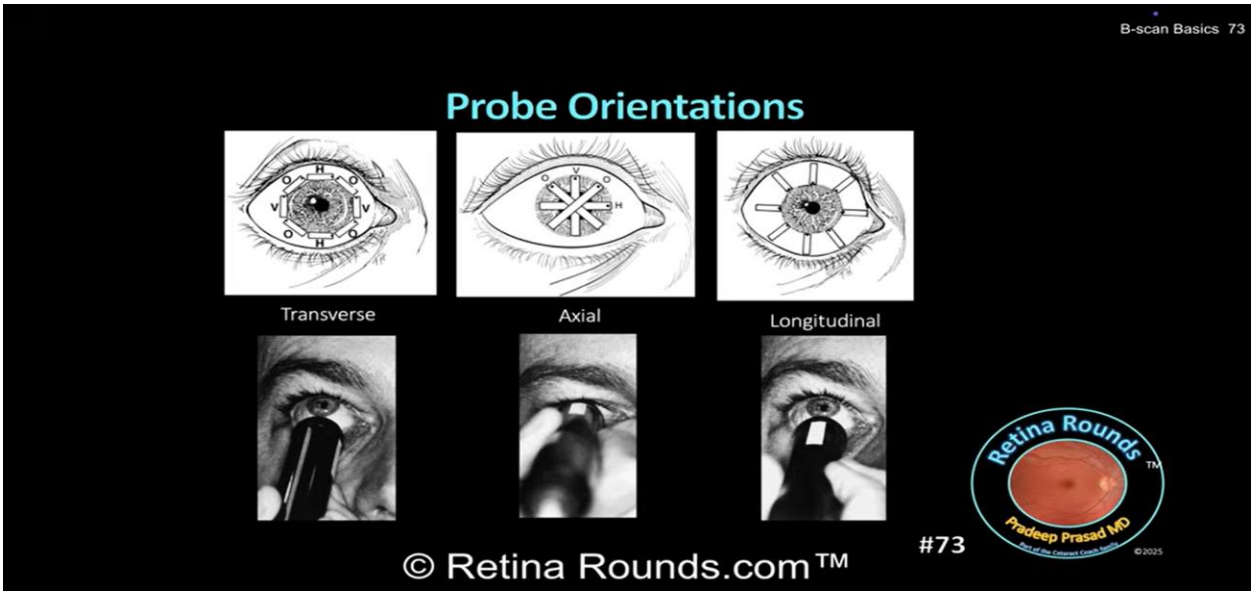
Now, just a couple of points about imaging the macula. All three scans, axial, transverse, and longitudinal, can be used to image the macula. Here, we're showing you an L9 scan or a longitudinal scan at 9:00. The bottom of the B scan image shows the optic nerve, and the top of the B scan image shows the periphery at 9:00. The area adjacent to the nerve is the macula and

you can see that uh that there is a hyperechoic membrane that's present that's concerning for a retinal detachment.

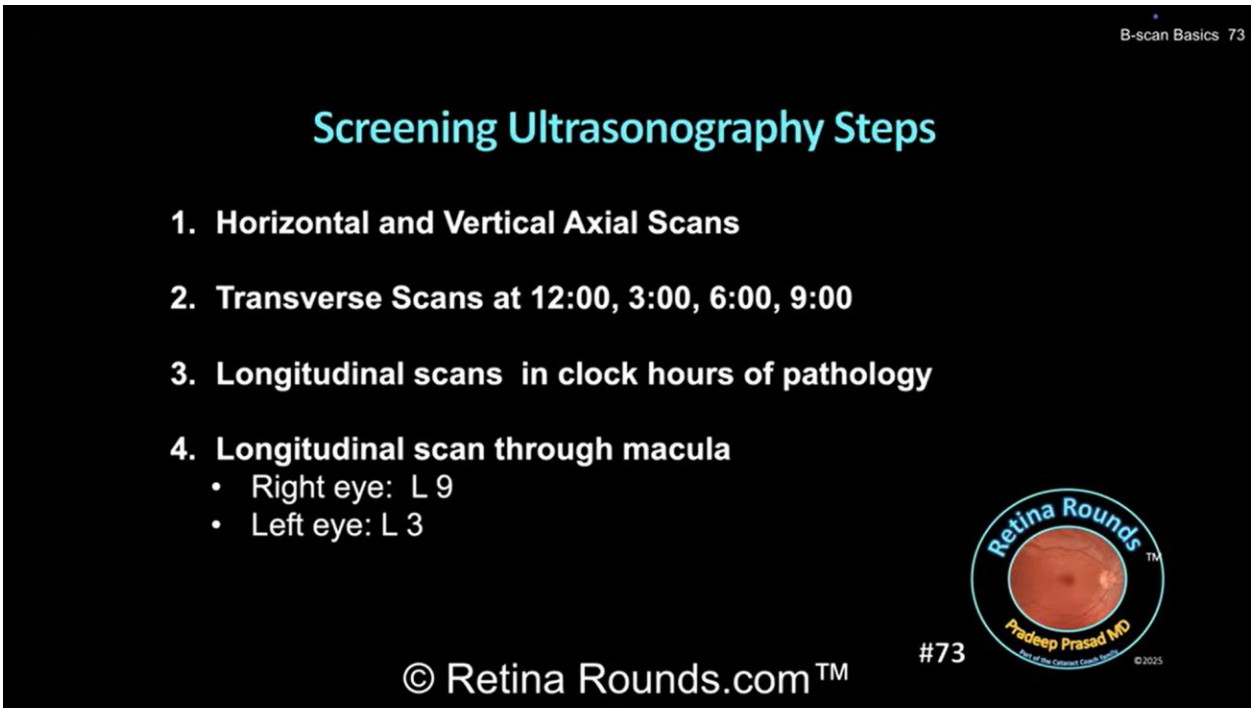


The macula can also be imaged with an axial scan as shown here. This is a horizontal axial scan. The optic nerve is seen in the middle of the B scan image. Since the probe marker is pointed towards the nose, we know that the upper part of the image represents 3:00 and the bottom part of the image represents 9:00. Therefore, in the B scan image, the macula is going to be seen below the optic nerve since the macula is going to be between the optic nerve and the 9:00 hour position.

Here's a diagram showing the various probe orientations for transverse, axial, and longitudinal scans. The white rectangles represent the scanning path of the ultrasound and the black dot indicates the location of the probe marker.



With these fundamentals in mind, here is my approach to performing a screening ultrasound. Now, this isn't the only way to do a screening ultrasound, but it's my approach. I do this consistently and find that it's a good way to make sure that posterior segment pathology is not missed. I first start with the horizontal and vertical axial scans to get a basic idea of what's happening in the posterior pole. Next, I perform transverse scans at 12:00, 3:00, 6:00, and 9:00. For each clock hour, I tilt the probe to sweep posteriorly, then more anteriorly towards the equator, and then finally anteriorly towards the anterior periphery. If I see any pathology, I'll perform additional longitudinal scans in that clock hour to gain more anteroposterior anatomic information. Lastly, I perform a longitudinal scan through the macula. For the right eye, this is an L9 scan or a longitudinal scan at 9:00. For the left eye, this is an L3 scan or a longitudinal scan at 3:00.

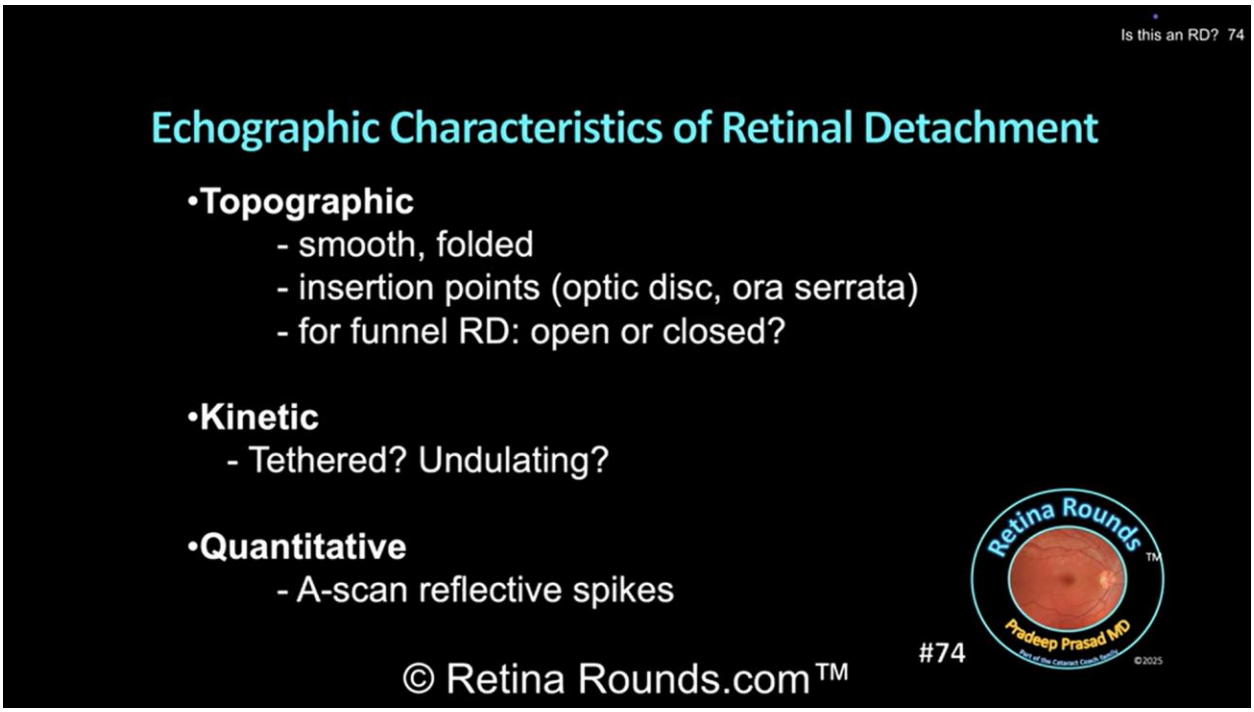


Remember, ultrasound mastery takes time and reps, but if you put in the time, you'll find that ultrasonography is an extremely valuable tool in your toolbox.

- **Is this a Retinal Detachment? Ultrasound Clues to Differentiate Retinal Detachments from Other Pathology**

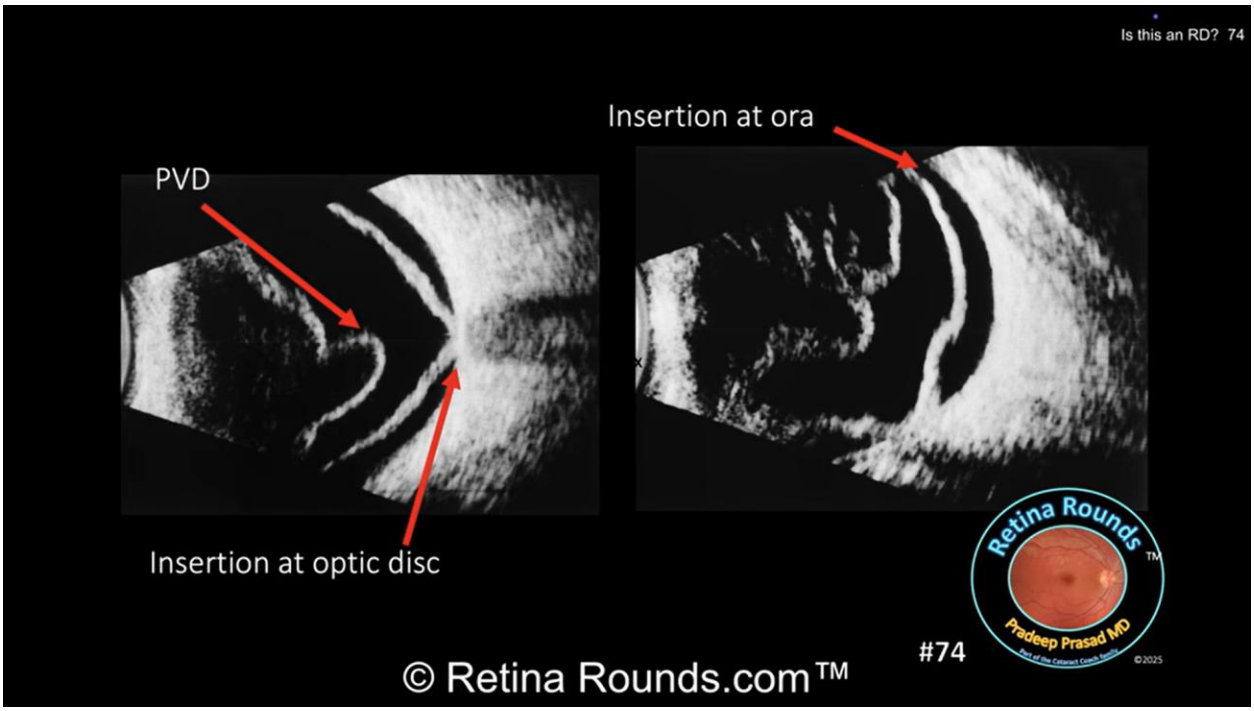
Link: https://www.youtube.com/watch?v=iyWeJY07nug

Let's start by talking about the echographic features of a retinal detachment and later we'll show you some examples of other pathology that can mimic a retinal detachment. When evaluating a hyperechoic membrane and trying to determine if it represents a retinal detachment, we can use ultrasonography to gain three pieces of information: topographic kinetic and quantitative.

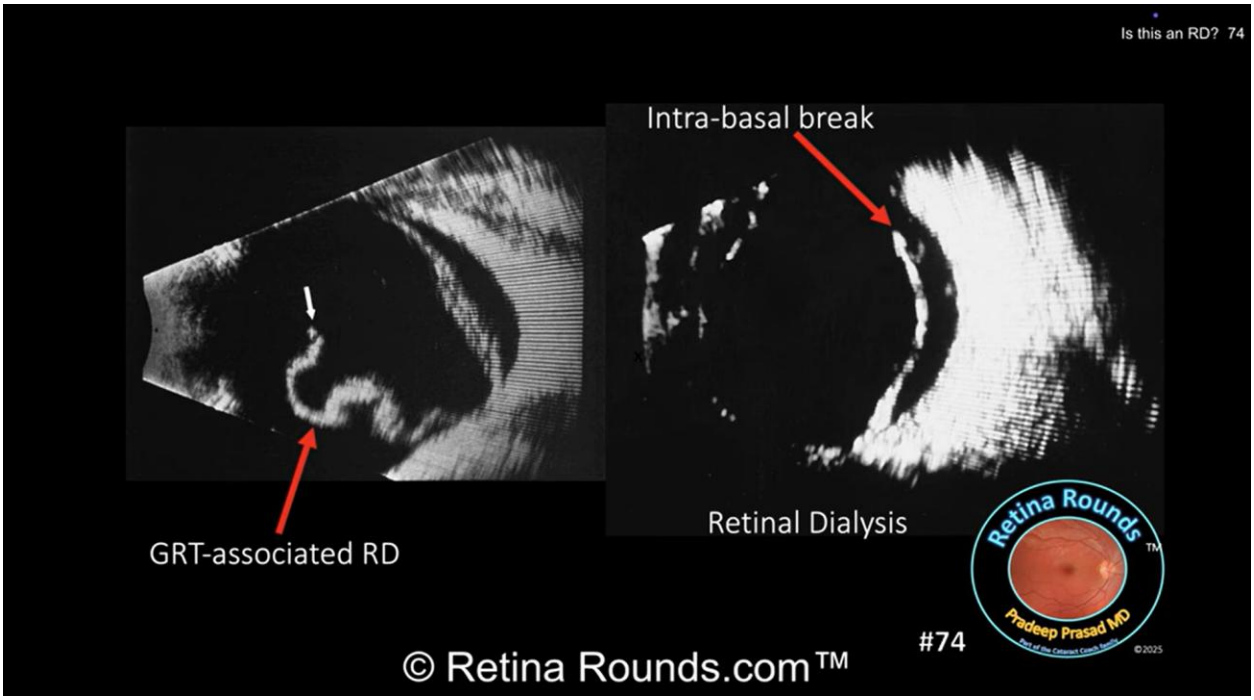


With respect to topography: retinal detachments will usually be folded or irregular rather than smooth, and the membrane will insert on the disc and the ora serrata. On kinetic examination where the patient's eye is moving back and forth during ultrasonography retinal detachments appear to move in a tethered fashion rather than an undulating fashion and lastly the A scan can help to identify a hyperechoic spike that is characteristic of retina.

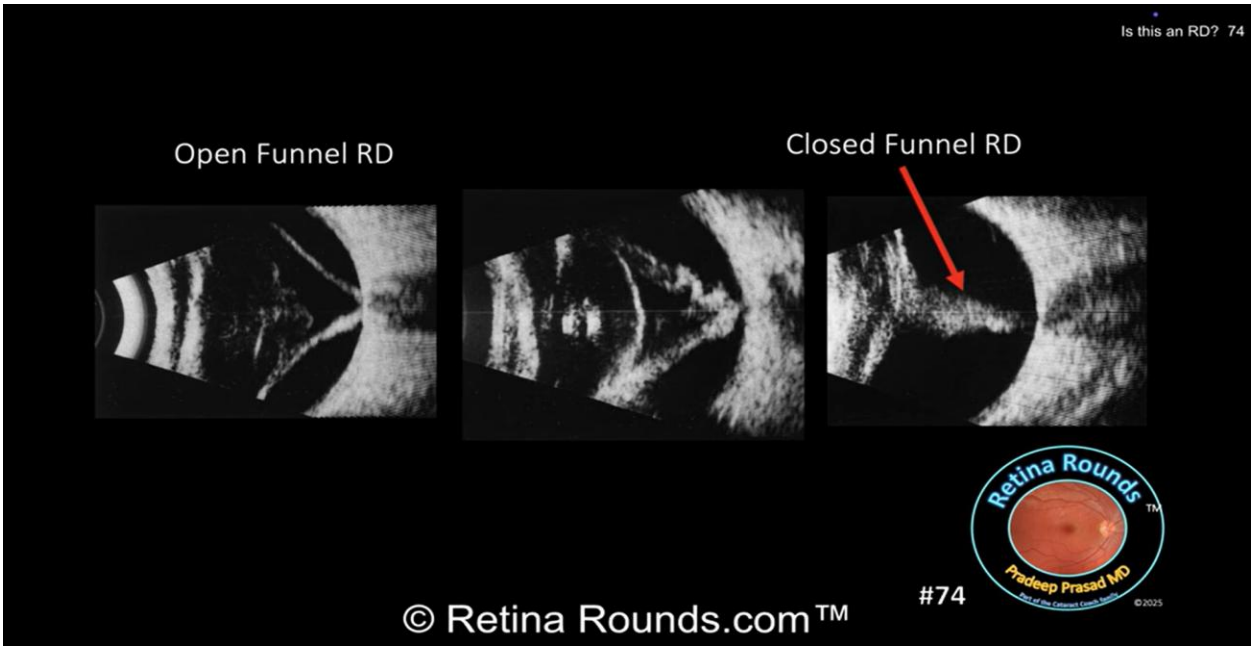
Here's an ultrasound showing two hyperechoic membranes The image to the left is an axial scan and you can see one of the membranes inserts on the optic nerve; this is the retina The image to the right is a longitudinal scan in the same patient We can see that anteriorly the membrane inserts on the ora serrata providing additional evidence that this is retina.



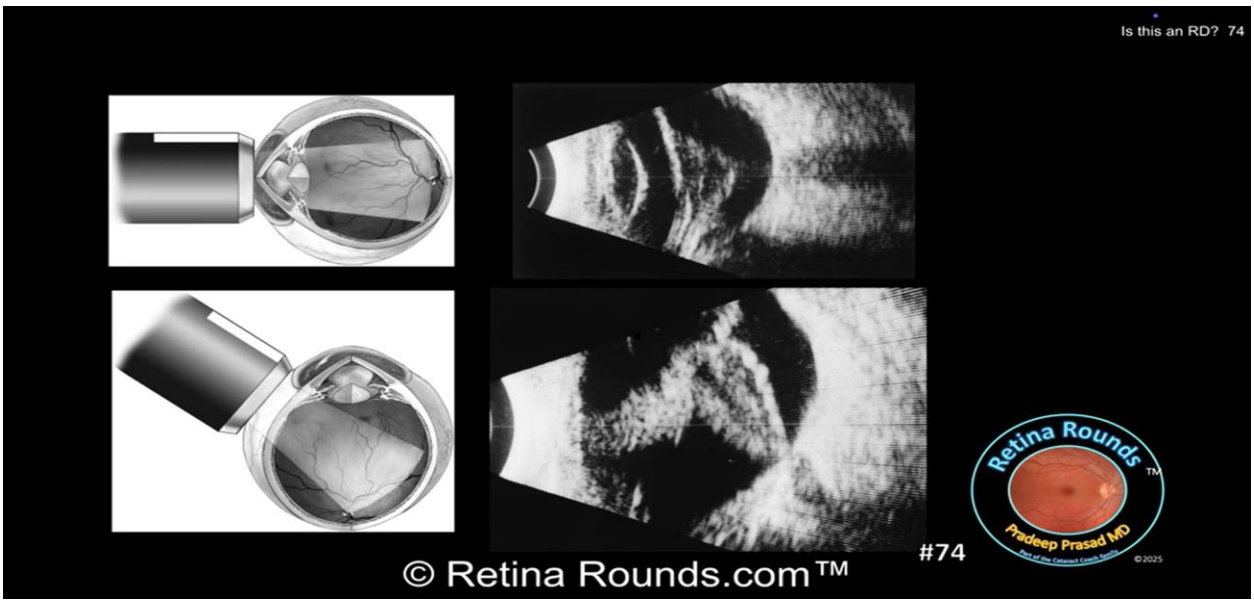
Retinal detachments tend to have a folded or irregular surface as opposed to a serous choroidal detachment that has a smooth almost dome-shaped appearance. The image to the left is a GRT associated retinal detachment and you can see the folding of the retina and its insertion on the optic disc. You do have to be careful with respect to topography because sometimes retinal detachments can also have a smooth appearance. The image to the right is a retinal dialysis. You can see an anterior break which is located anteriorly within the vitreous base and this retinal detachment has a little bit more of a smooth appearance.



Ultrasonography can also be helpful to characterize total retinal detachments. Here is a progression of scans over time for the same patient. The image to the left is an open funnel retinal detachment. As time progresses you can see irregular folds of the retina which are seen on the on the middle image which probably represents some of the effects of PVR. Finally in the image to the right you can see that the detachment progresses all the way to a closed funnel configuration.

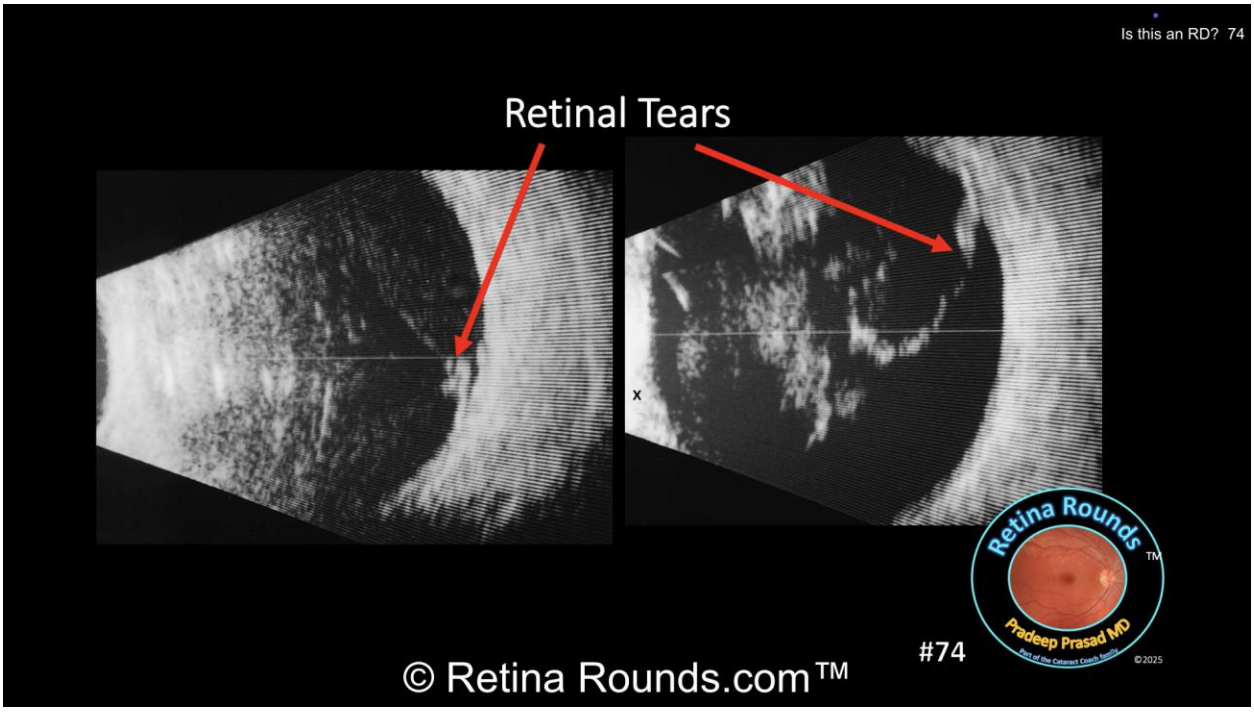


It's important to image membranes from various angles to determine if it's retina or not. The top image shows an axial scan and the hyperechoic membrane does not appear to insert on the optic nerve. However, when imaged using a longitudinal scan you can clearly see the closed funnel configuration of the retinal detachment with its insertion on the optic nerve.

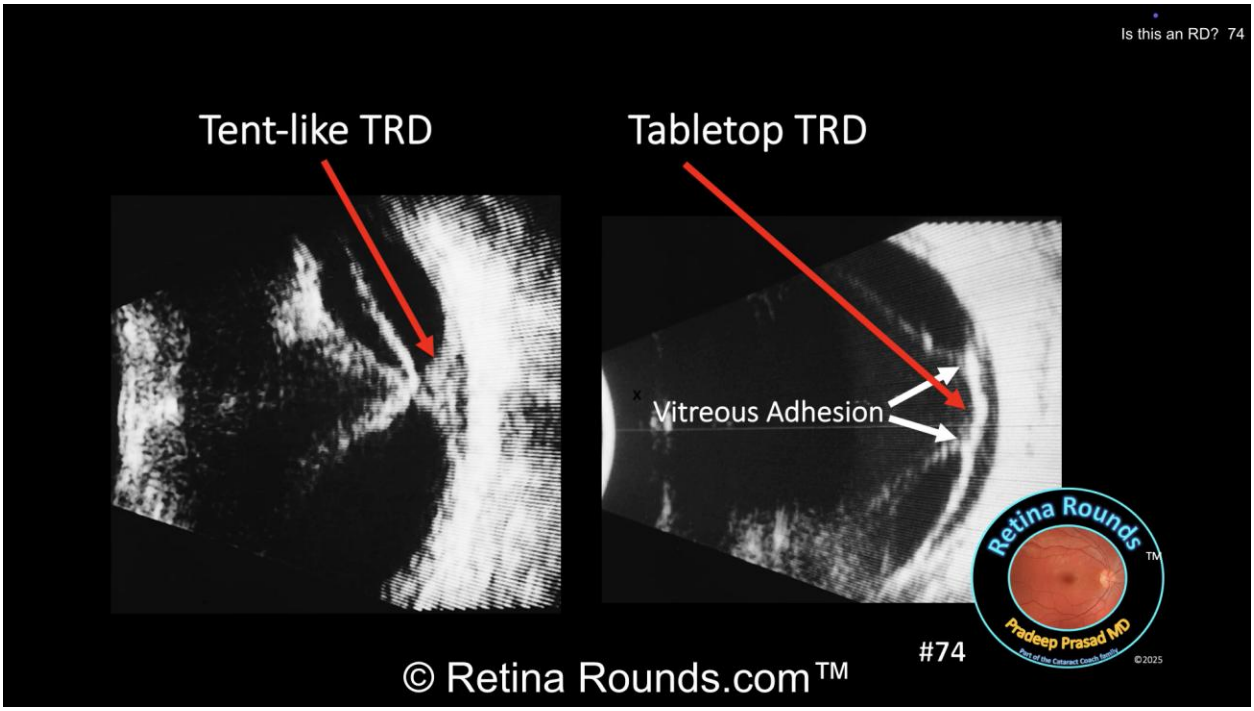


Very advanced atrophic closed funnel retinal detachments may not be readily visible on axial scans. Again, you can see on the top image that the axial scan doesn't pick up the retinal detachment but when viewed with a longitudinal scan which is the image on the bottom one can appreciate a thin atrophic closed funnel detachment.

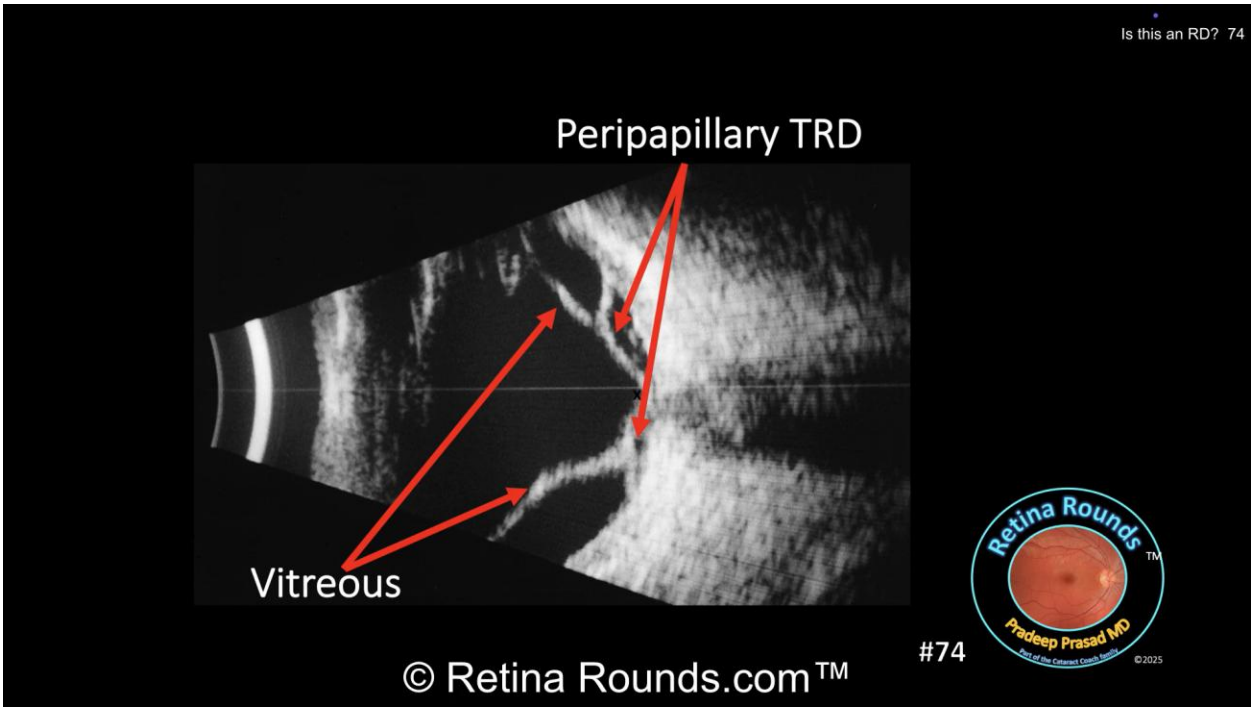
Ultrasonography can not only help to identify retinal detachments but also retinal tears There's a vitreous hemorrhage that's present in both of these scans precluding a clear view to the retina. But in both scans you can appreciate a flap tear of the retina.



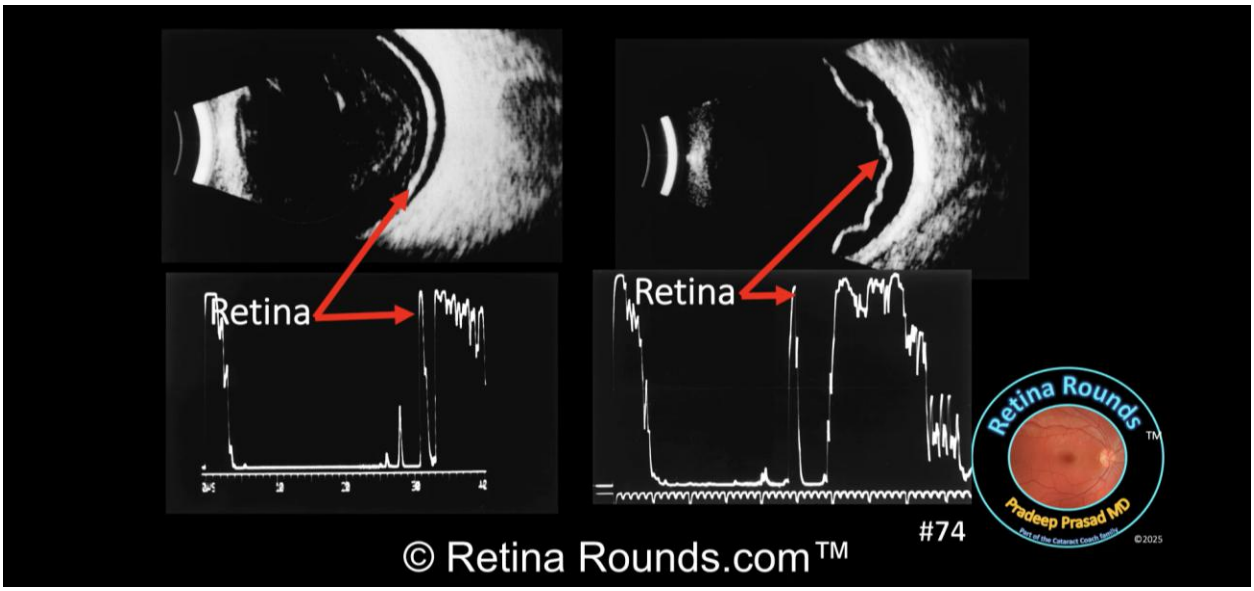
Tractional retinal detachments can also be appreciated on ultrasonography. The image on the left shows a tent-like tractional retinal detachment. The image on the right shows a tabletop TRD with a membrane of vitreous that's inserting on the retina with a broad area of adhesion that exerts broad traction on the underlying retina.



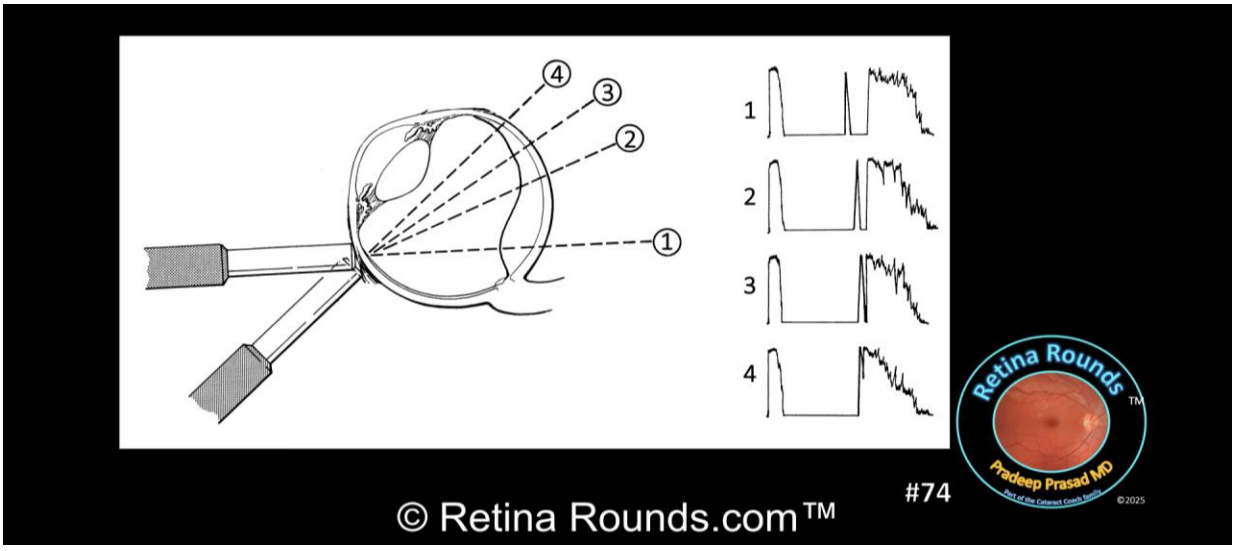
Here's another example of a parapapillary TRD. You can see membranes of the vitreous pulling on the retina surrounding the optic nerve.

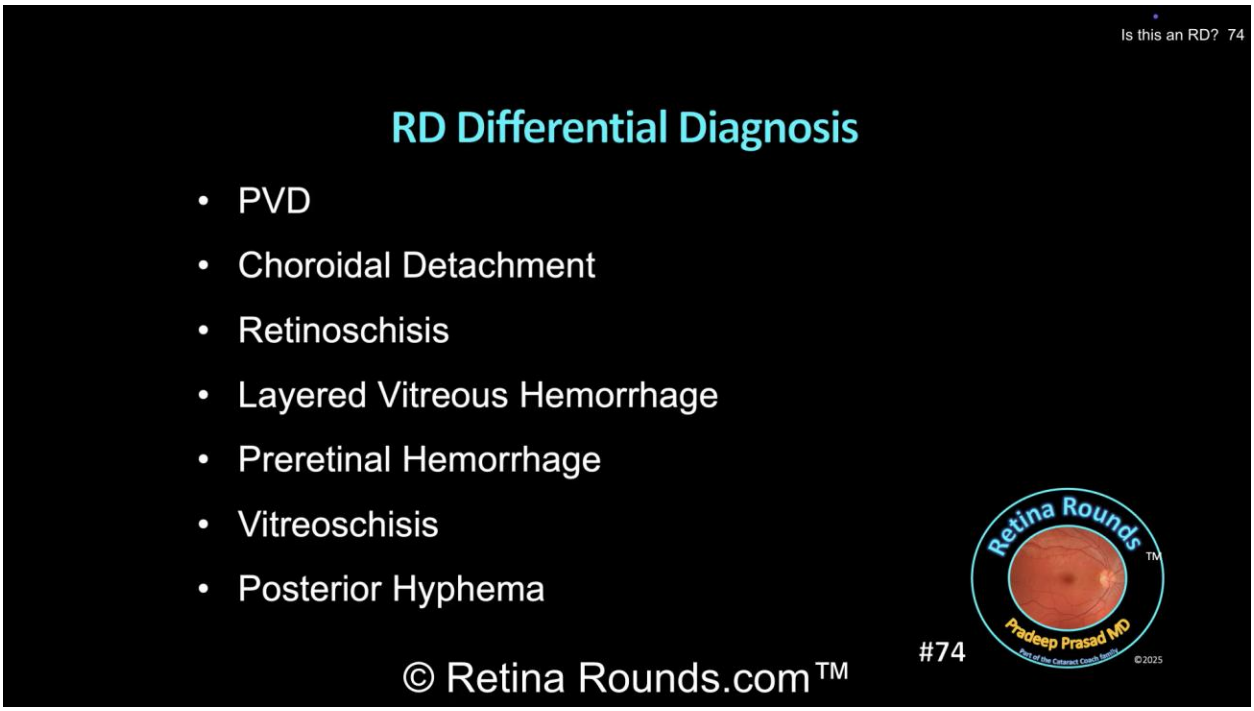


Here's a quantitative assessment of a hyperechoic membrane. You can see the arrows pointing to the membrane in the corresponding A scan spike. The high A scan spike is characteristic of retina. You can see in the A scan on the right that the spike is farther away from the echoes of the underlying RPE, choroid, and sclera corresponding to an area of the detachment with greater fluid and separation of the retina from the underlying RPE.

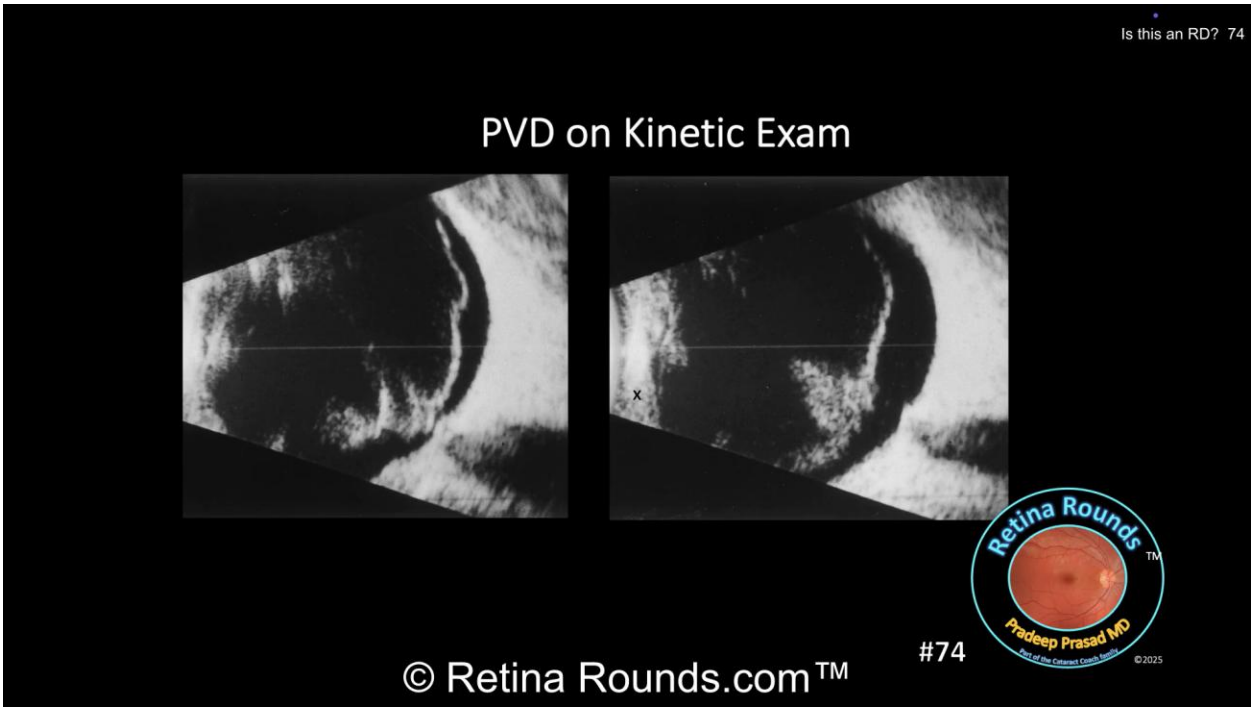


Here's a schematic showing how the retina A scan spike changes in distance from the echoes of the choroid and sclera depending on what part of the retinal detachment is visualized. Scan number one looks at an area more posteriorly where the retina is more bullous. You can see the corresponding A scan marked one with a clear separation between the retina spike and the echoes of the RPE, choroid and sclera. Scan number four in contrast is imaging the retina more anteriorly where the detachment is shallow. You can see the corresponding A scan pattern marked four which shows a much smaller distance between the retina A scan spike and the echoes of the RPE, choroid and sclera.

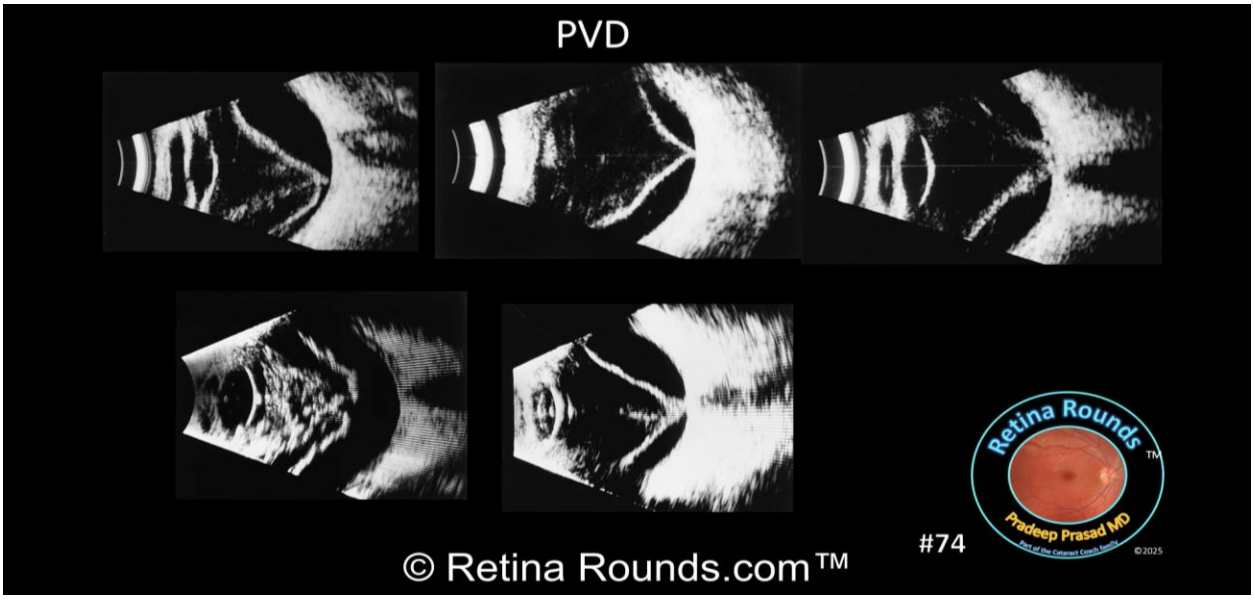




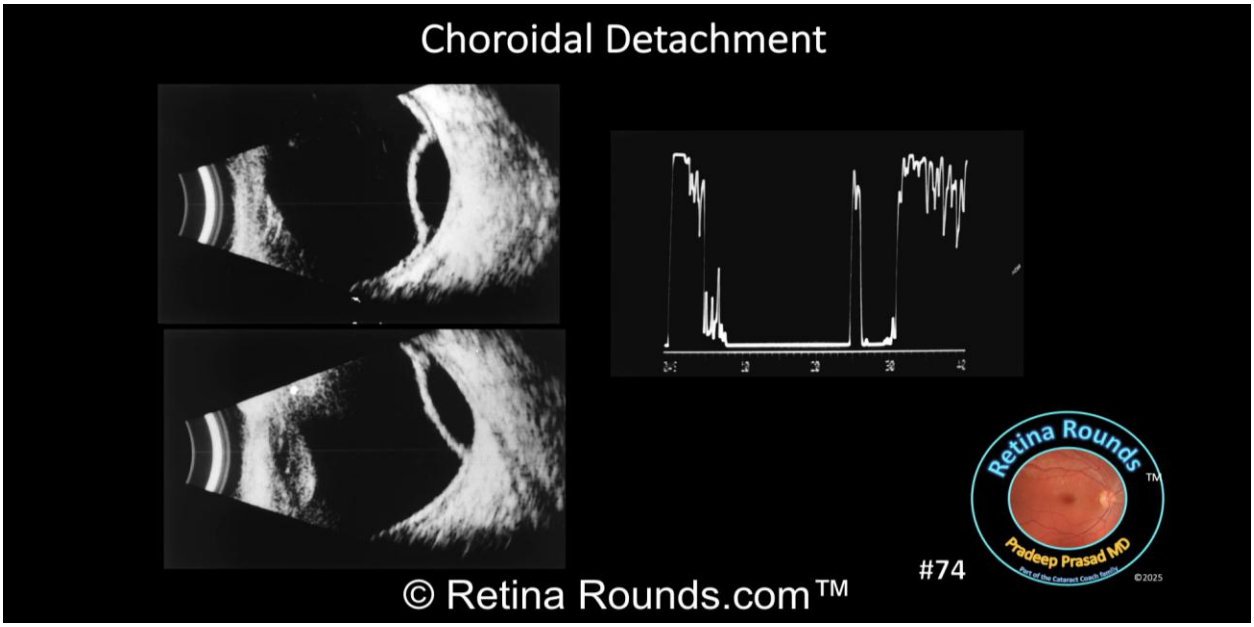
While a PVD may also insert on the optic nerve if you see that a membrane clearly does not insert on the optic nerve you can be confident that this does not represent retina. The image to the left shows a membrane in close proximity to the optic nerve and when the eye moves the image to the right shows that membrane moving away from the optic nerve not attached to the optic nerve consistent with a PVD.



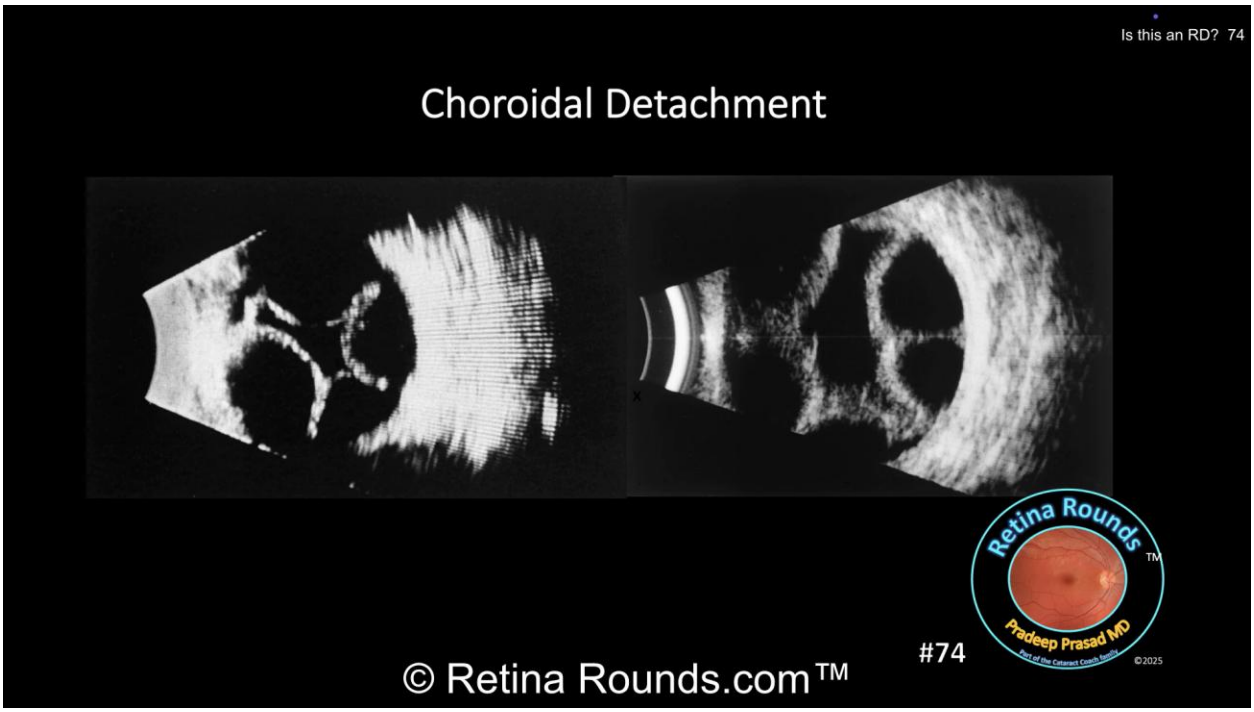
PVD now sometimes an incomplete PVD may be present. In these scans you can see a number of examples of a hyperechoic membrane that inserts on the retina but not directly on the optic nerve. In some cases, this can be tricky because the adhesion point is close to but not quite involving the optic nerve. These areas of adhesion between the retina and the vitreous can be seen for example in patients with diabetic retinopathy and an incomplete PVD where the point of adhesion corresponds to the location of a fibrovascular peg.



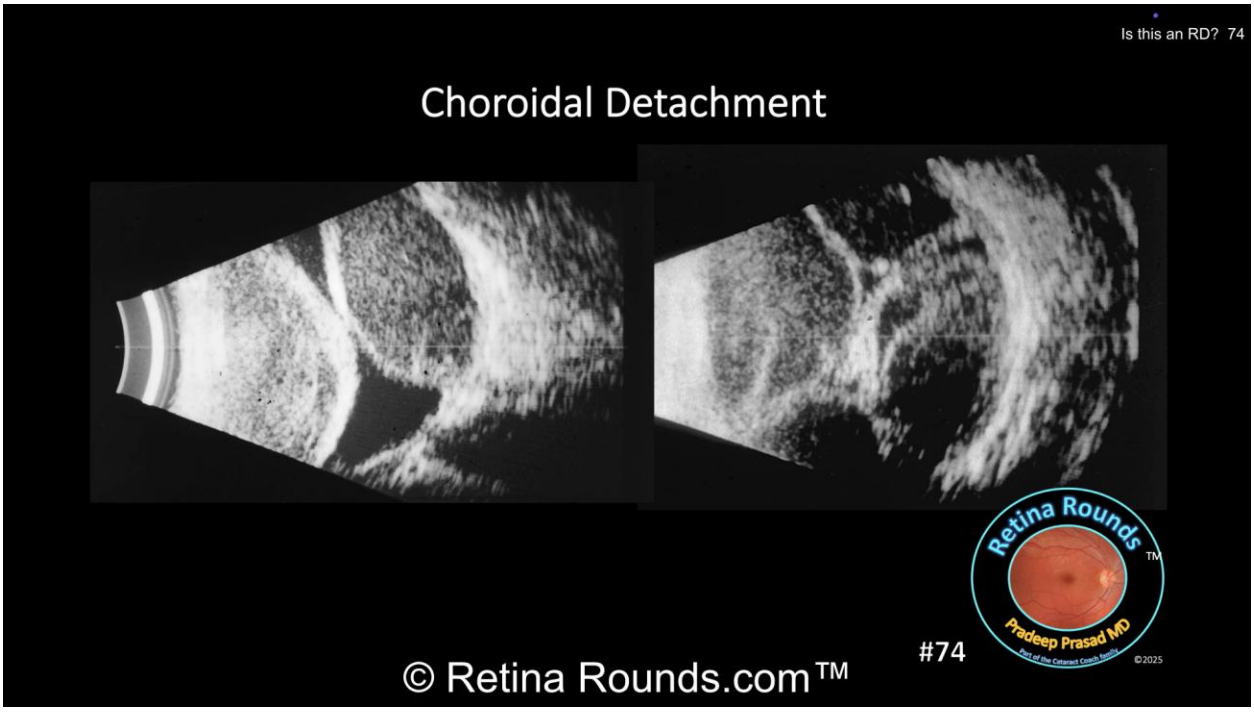
Here's an ultrasound of a serous choroidal detachment. You can see this membrane has a dome-shaped or smooth appearance and will not move on kinetic exam. We know it's serous rather than a hemorrhagic choroidal since the area under the membrane is hypoechoic.



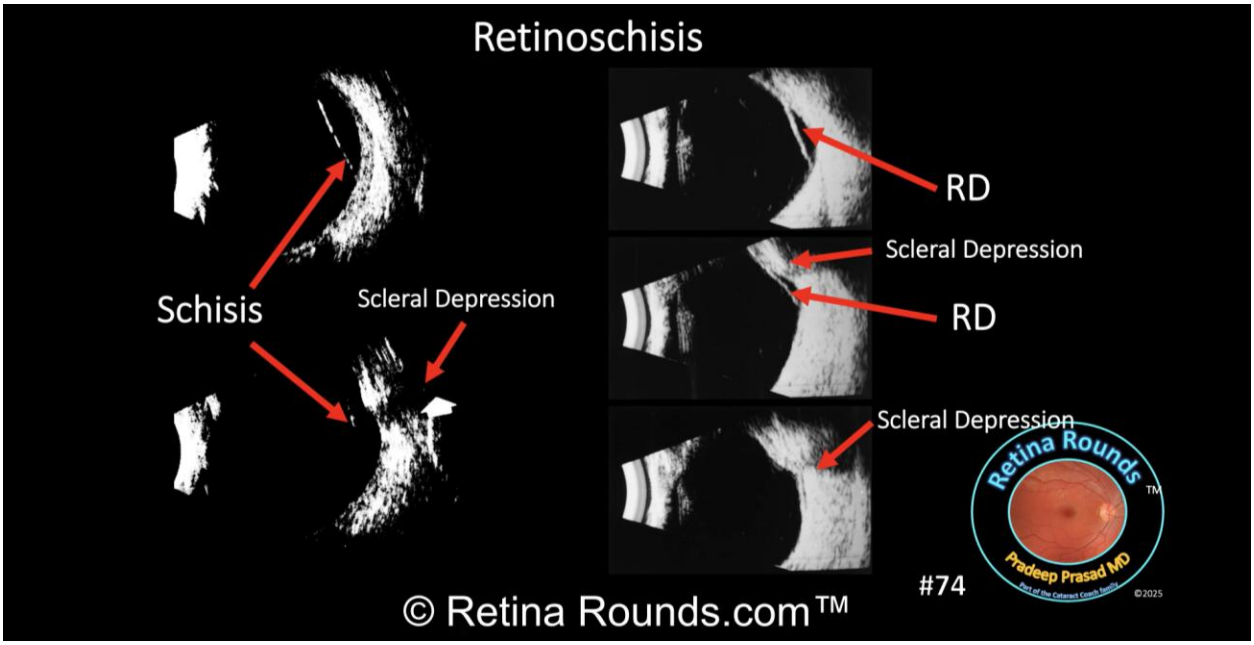
On transverse scan the choroidal can have a lobular appearance as is demonstrated here. Again, these membranes would not move on kinetic exam further distinguishing it from retina.



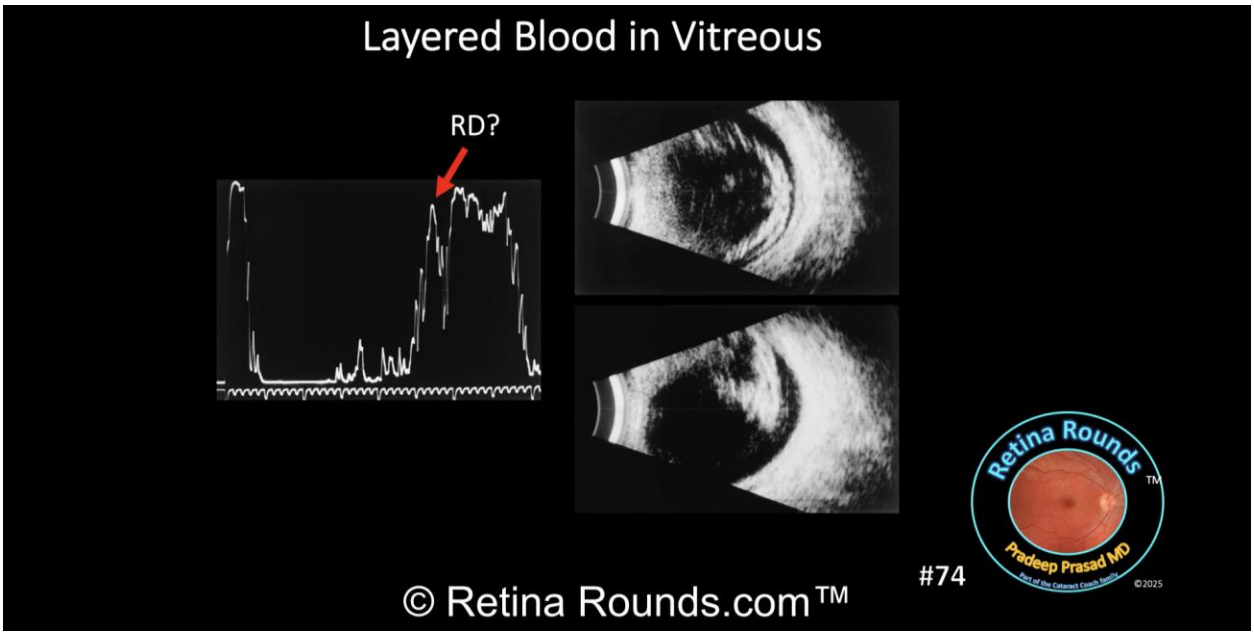
The image to the left shows appositional hemorrhagic choroidal detachments. The hemorrhage is visualized as the hyperechoic area underneath the membranes and on transverse view we can see a mixed pattern of echogenicity with some appearing to be more hyperechoic and other areas appearing hypoechoic suggesting a mix of hemorrhagic and serous choroidal detachment.



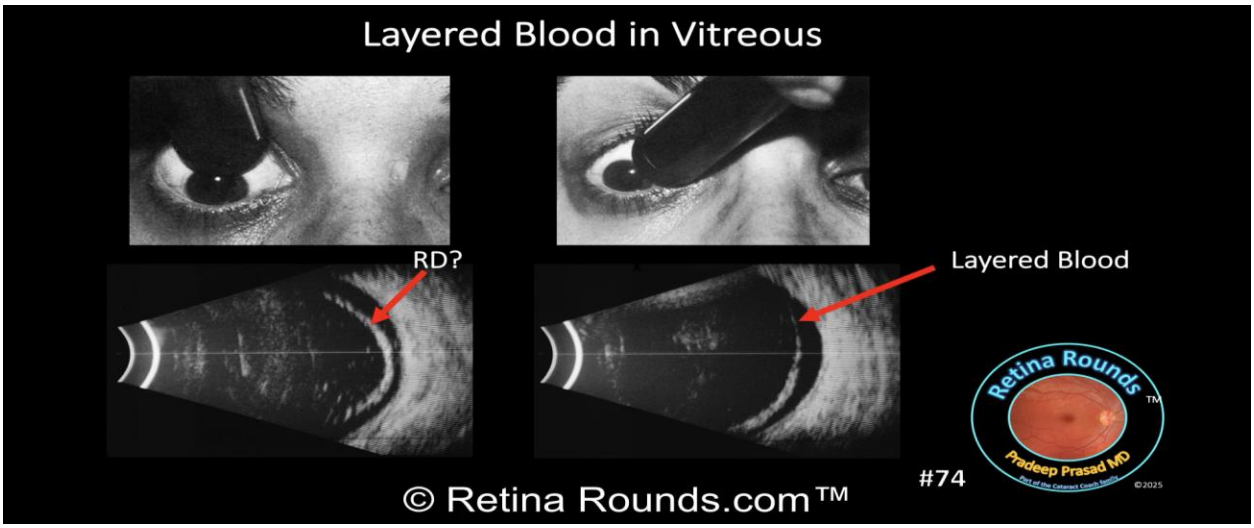
If media opacity precludes direct visualization, ultrasonography can also be useful to distinguish a schisis cavity from a retinal detachment. On the left you can see a schisis cavity. When this cavity is sclera depressed the cavity does not collapse as can be seen on the lower left image. This is unlike the membrane and cavity on the right which is a retinal detachment. You can see that the scleral depression collapses this cavity. This corresponds to the type of appearance that would be present during fundoscopic examination and scleral depression.



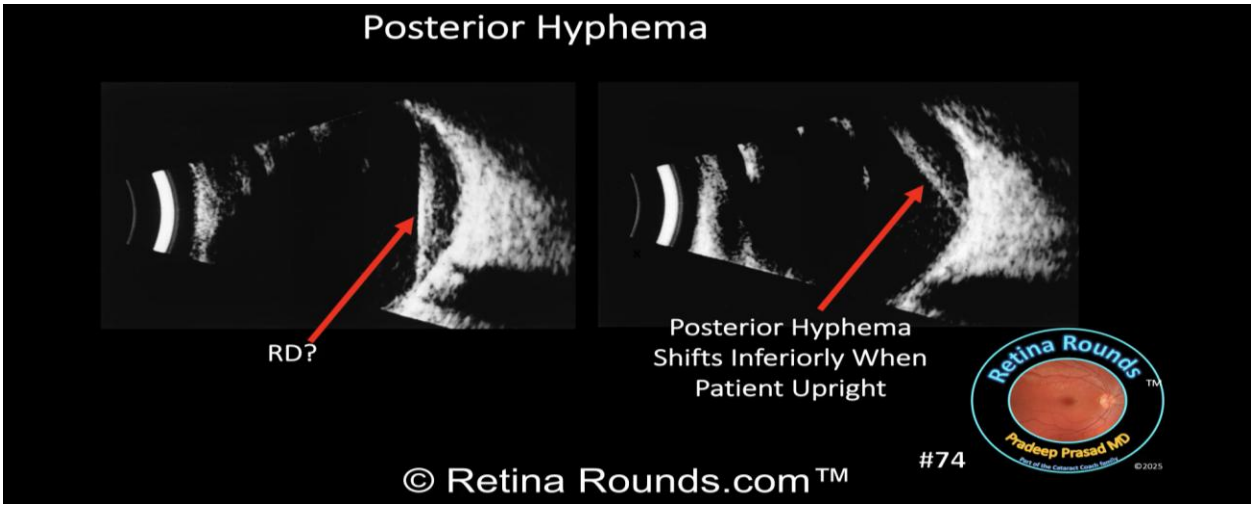
Layered blood in the vitreous especially inferiorly can often mimic a retinal detachment, and this is a common finding in patients with PDR and vitreous hemorrhage. You can see an A spike that is corresponding to this hyperechoic membrane and the question is whether this represents retina.



One trick to distinguish layered inferior vitreous hemorrhage from retina is to follow the membrane to its edges. The image on the left shows a transverse scan at 6:00 with visualization of an inferior hyperechoic membrane. Again, is this retina? well the image to the right shows a transverse scan at 7:30 So now looking at the inferotemporal quadrant looking at more at the edge of this hyperechoic membrane and you can see that the hyperechoic membrane appears to fade away. This is very characteristic of layered blood since the hemorrhage is predominantly inferior due to gravity, the blood stains the vitreous most inferiorly. But when the same area is visualized more temporally or nasally, the degree of hemorrhage diminishes and the membrane appears fainter and may even fade away. If this were retina, the hyperechoic membrane would remain the same and not fade away.

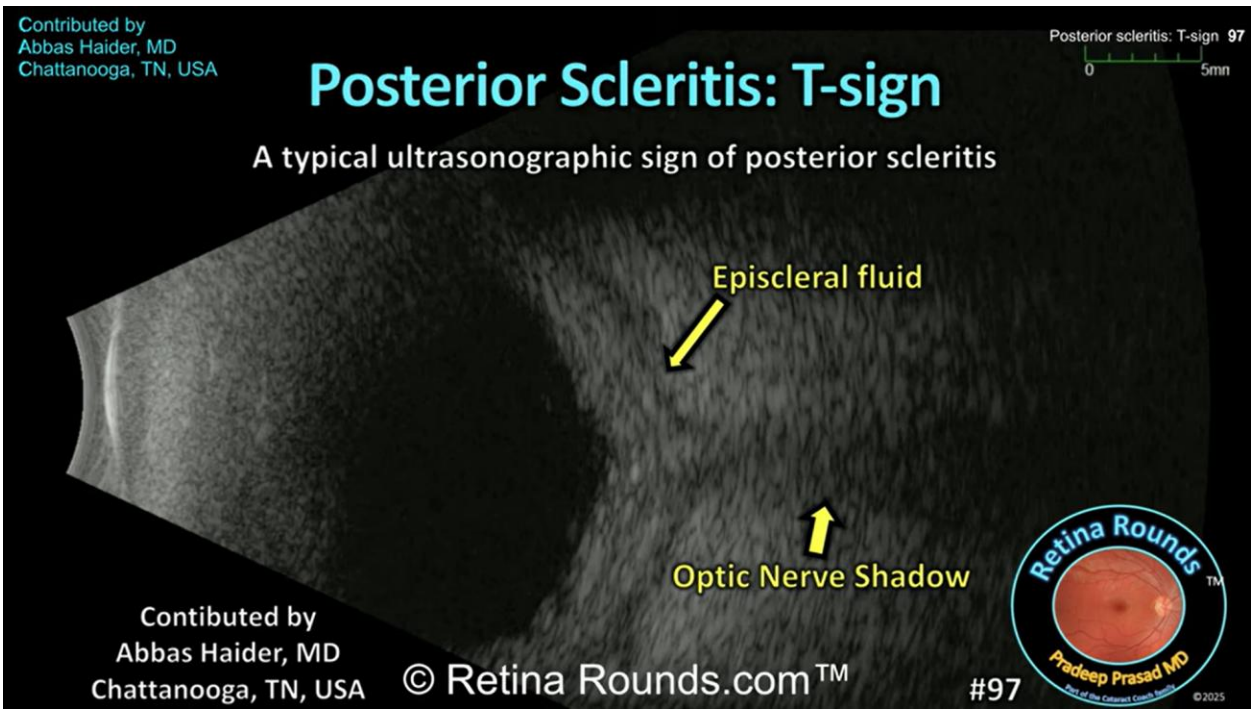


Here's an example of a posterior hyphema. The image to the left shows a longitudinal scan at 6:00 when the patient is in the supine position. The hyperechoic material appears to be proximal to the optic nerve which raises the suspicion for a retinal detachment. However, when the patient is seated upright and the same longitudinal scan at 6:00 is performed you can see that that hyperechoic material shifts inferiorly away from the optic nerve and that's very consistent with a posterior hyphema.



- **Posterior Scleritis: T-Sign**

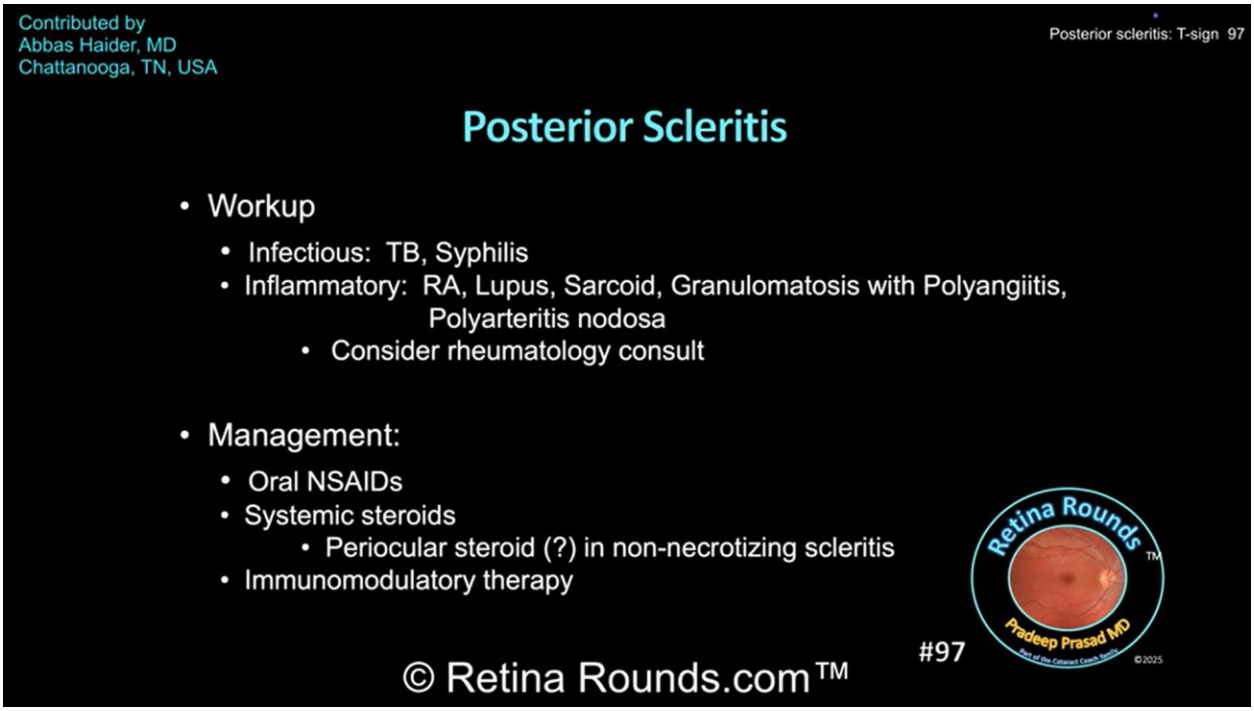
Link: https://www.youtube.com/watch?v=-CdzSOmF5Ec



B-scan ultrasonography can be an extremely helpful diagnostic tool in a variety of ophthalmic conditions. One example of this is in patients with suspected posterior scleritis. Since anterior segment findings may be absent or limited, b-scan ultrasonography can show characteristic features of posterior scleritis including episcleral fluid and choroidal thickening. Episcleral fluid can be seen as a hypoechoic layer just posterior to the sclera and, when visualized adjacent to the optic nerve, this forms the so-called "T-Sign." In today's episode, our returning contributor, Dr. Abbas Haider, shows us a great example of the t-sign in a patient with posterior scleritis. Thank you Dr. Haider for your contribution!

Posterior scleritis can have a number of associated signs and symptoms, but perhaps the most typical clinical feature is its association with deep sort of a boring ocular or orbital pain. This pain may even wake patients up at night. Since posterior scleritis by definition is in the posterior wall of the eye, the anterior surface of the eye may appear relatively quiet with very little redness or pain to palpation anteriorly. Other signs may include proptosis, ocular motility disturbances and orbital inflammation. In fundoscopic exam, one might see choroidal thickening with chorioretinal folds, serous retinal detachments and even nerve edema if the scleral inflammation is compressing the optic nerve. Since posterior scleritis can be associated with other systemic inflammatory conditions, one may also see signs of retinal vasculitis which can include retinal vascular sheathing, exudates and hemorrhage.

Imaging can be very helpful to arrive at a diagnosis of posterior scleritis and ultrasonography as is shown in this case is one of the best diagnostic tools. Enhanced depth imaging OCT can also show choroidal thickening and serous retinal detachments. While fluorescein angiography may be relatively non-specific for posterior scleritis, one might see pinpoint hyperfluorescence or signs of retinal vasculitis.



So, in these cases a systemic workup is absolutely critical since these patients often have associated systemic conditions that can be either vision or life-threatening. Infectious etiologies such as tuberculosis and syphilis should definitely be ruled out. This is especially true since immunosuppressive anti-inflammatory therapy that's typically used to manage posterior scleritis can make infectious processes worse. A number of rheumatologic conditions can be associated with posterior scleritis, but rheumatoid arthritis is by far the most common. Other systemic rheumatologic conditions include lupus, sarcoidosis, granulomatosis with polyangiitis, polyarteritis nodosa and others. One of the key take-home points here is that consultation with the

rheumatologist is highly recommended not only to help identify the underlying condition but also, they'll be helpful to aid in management.

Posterior scleritis can be treated with oral NSAIDs although often in these patients systemic steroids may be necessary and that can include either oral steroids or even high dose intravenous steroids in more severe cases. While there are reports of periocular steroids being beneficial in patients with scleritis, these should generally be avoided in cases of necrotizing scleritis and that can be really difficult or not possible to ascertain in cases of posterior scleritis. And lastly, steroid sparing immunomodulatory therapy may be necessary in cases of either chronic or recurrent posterior scleritis. This is a great demonstration of the ultrasonographic features of posterior scleritis and we want to thank Dr. Haider again for his very helpful contribution. Thanks for watching.

- **Peripheral Retinal Pathology: Part 1**

Link: https://www.youtube.com/watch?v=oSotMhWS6JE

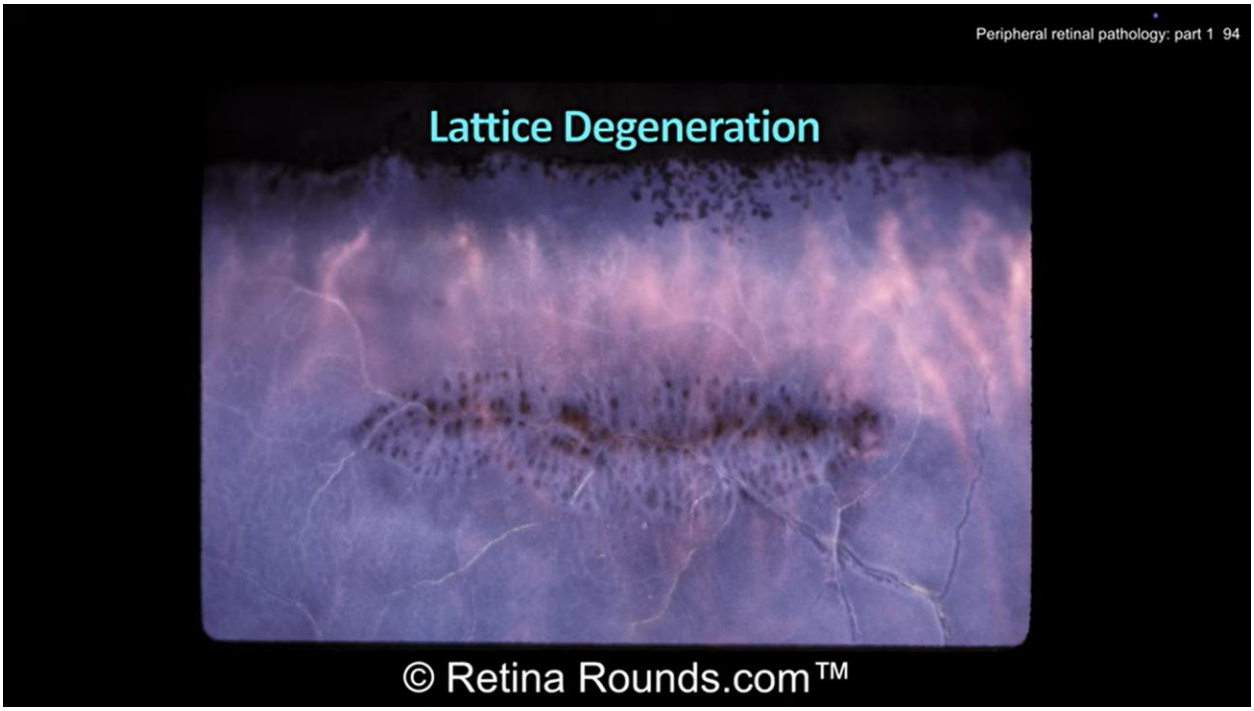
Today we're going to review the anatomic features of peripheral retinal pathology and in particular those lesions that can predispose to a retinal tear or detachment. This information every ophthalmologist should be familiar with since identification and in some cases prophylactic treatment of these lesions can help prevent your patients from developing retinal detachments.

Before we dive in, I want to stress the importance of a good fundoscopic examination with scleral depression. Now many of the lesions that we'll discuss are in the far periphery and scleral depression not only brings these lesions into view but the oblique viewing angles can help you visualize subtle holes or breaks that would otherwise be missed. While wide-field fundus photography is a very powerful diagnostic tool it is not a replacement for fundoscopy with scleral depression.

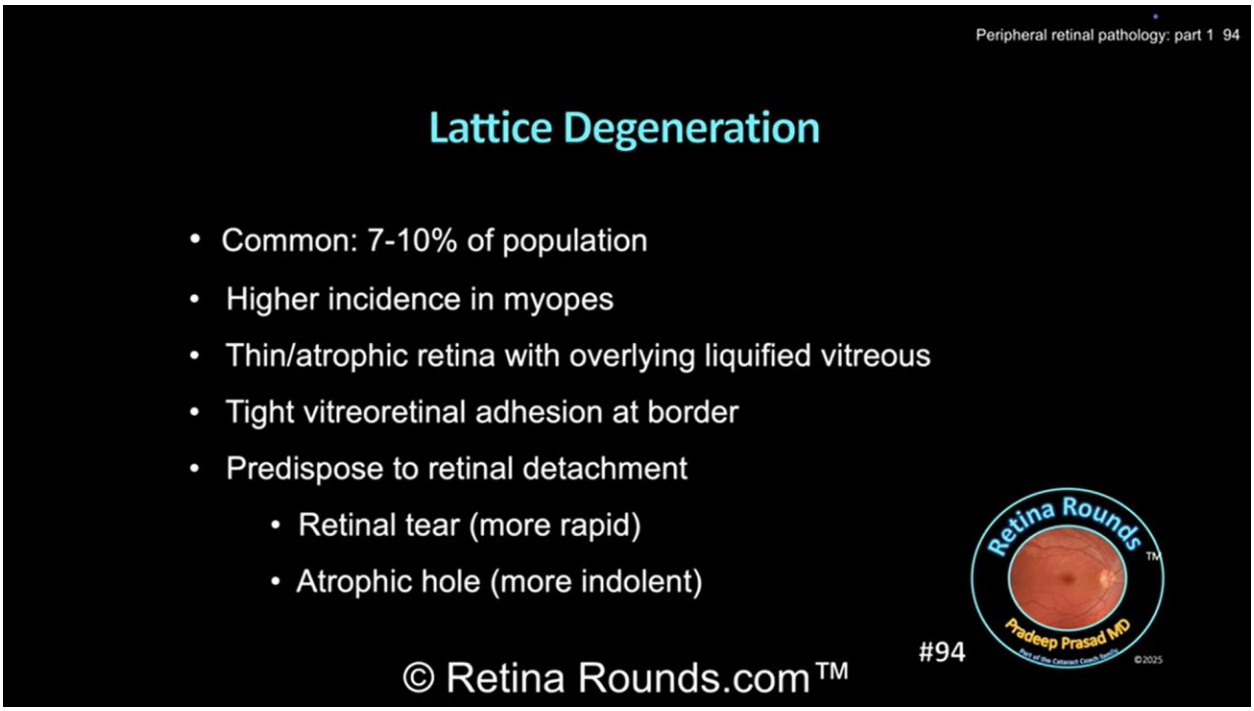
First let's distinguish lesions that predispose to a retinal tear or detachment from those that do not. Lesions that predispose to a retinal tear or detachment include lattice degeneration, snail tract degeneration which has many features that are similar to lattice degeneration, vitreoretinal

tufts, enclosed ora bays, meridional folds or complexes, and retinoschisis. Lesions that don't predispose to retinal tear or detachment include pavingstone degeneration, peripheral reticular degeneration, peripheral drusen, and typical cystoid degeneration.

As you know retinal breaks can lead to rhegmatogenous retinal detachments, although not all breaks are the same with respect to RD risk.

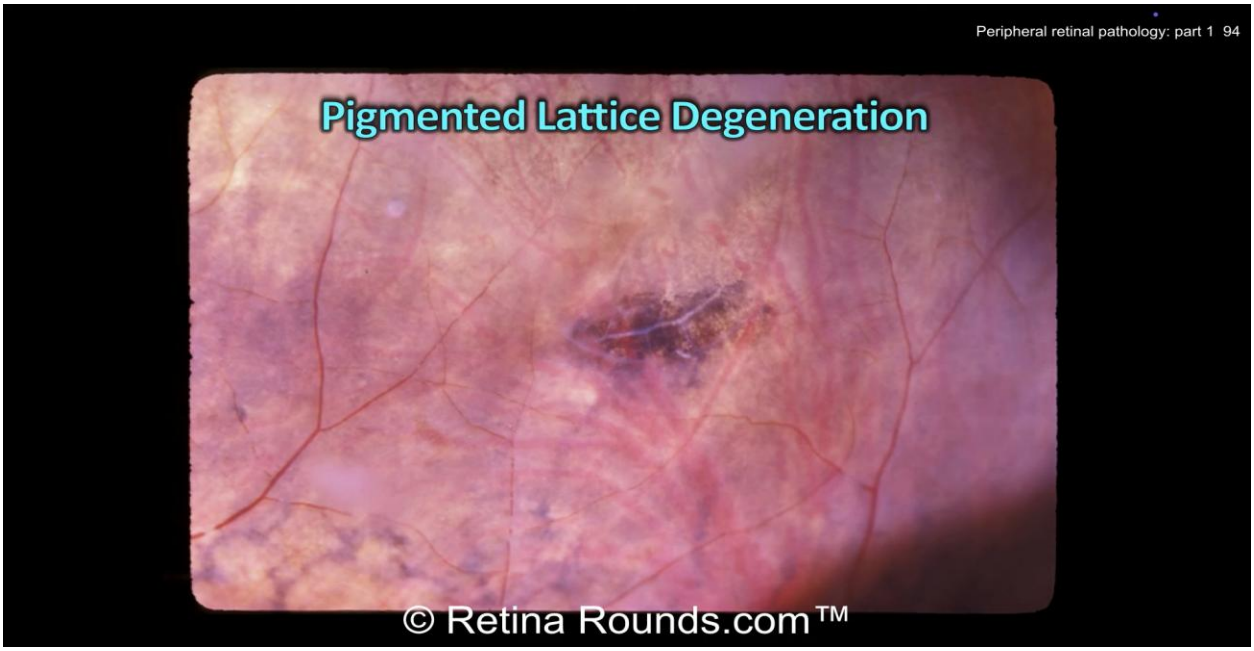


The photo shown here is typical of lattice degeneration which is usually located peripherally between the equator and the vitreous base.



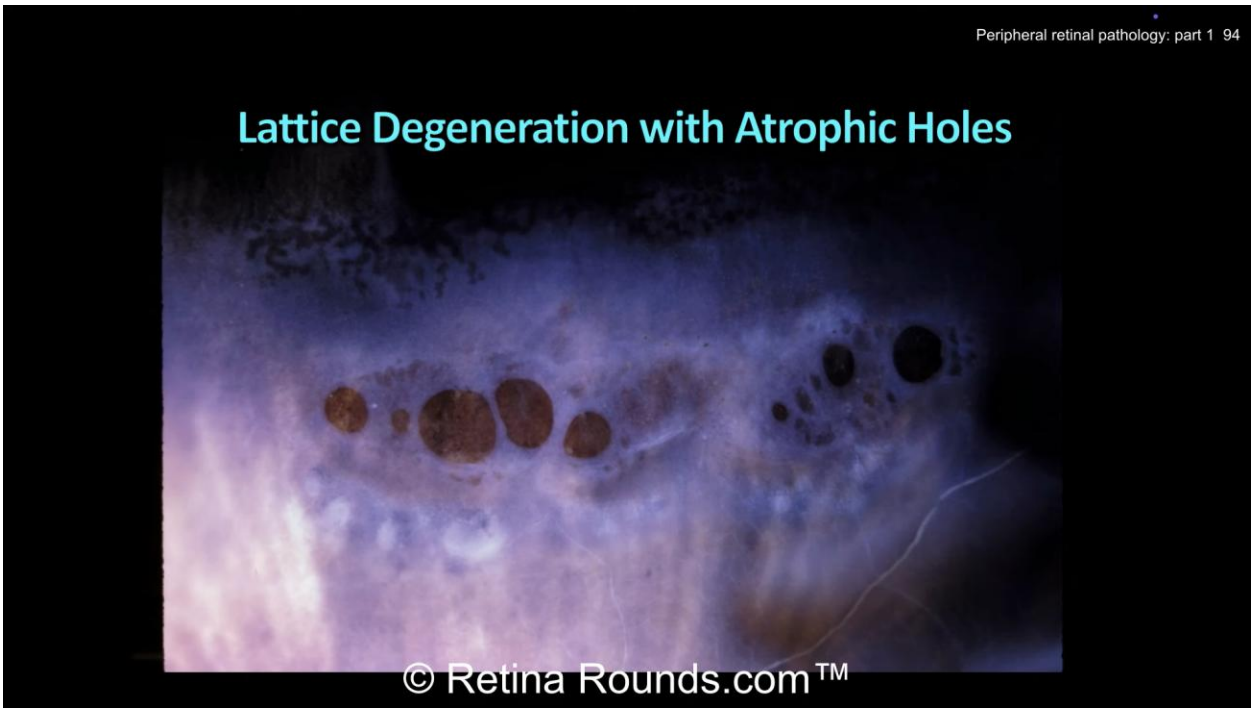
Lattice degeneration is common affecting about 7 to 10% of the population and it along with snail tract degeneration are found more often in myopes. Lattice is characterized by a central scalloped area of thin or atrophic retina with an overlying bursa of liquefied vitreous and tight vitreoretinal adhesions at the edge. These lesions can predispose to retinal detachments either secondary to a retinal tear or an atrophic retinal hole. Retinal tears usually occur at the edge of lattice where vitreoretinal traction is greatest and can progress more rapidly to retinal detachment. Atrophic holes on the other hand can be present anywhere within the bed of lattice and detachments from these lesions typically progress more slowly.

Lattice degeneration can have associated sclerotic appearing vessels as is demonstrated here.



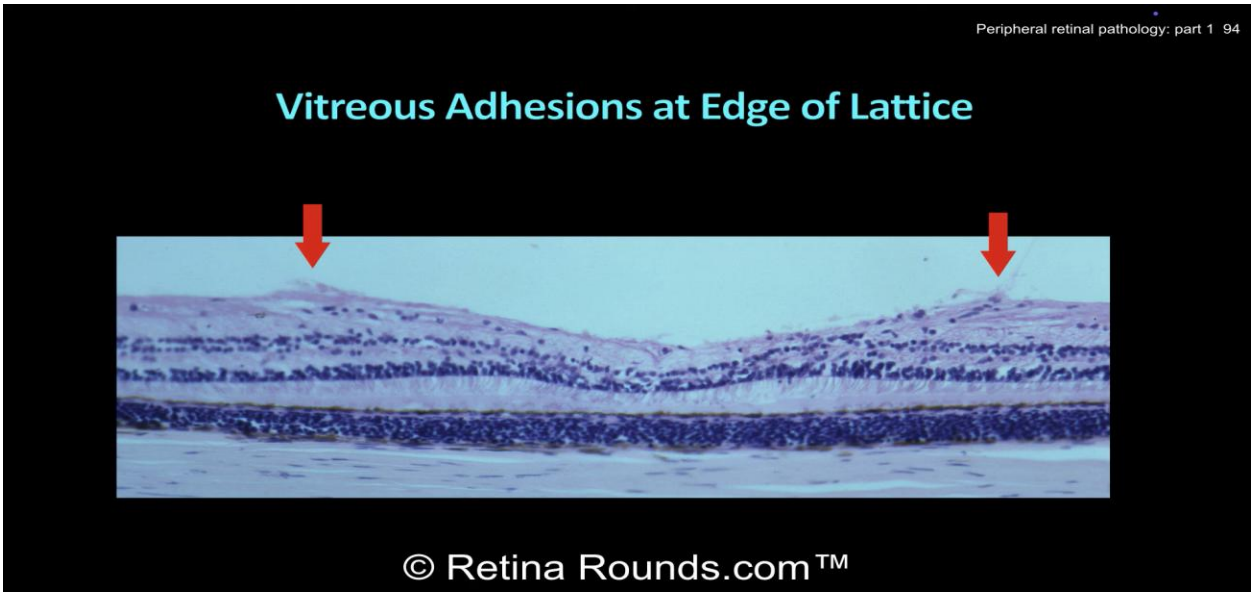
Hyperpigmentation either at the borders or even within the area of lattice may also be present as you can see here.

Sometimes the areas of retinal thinning can progress resulting in atrophic holes Here two smaller areas of lattice degeneration have associated small atrophic retinal holes and sometimes numerous atrophic holes may be present as is demonstrated here.



Now this picture shows an area of lattice degeneration with a small retinal tear to the left of the image and an atrophic hole to the right of the image.

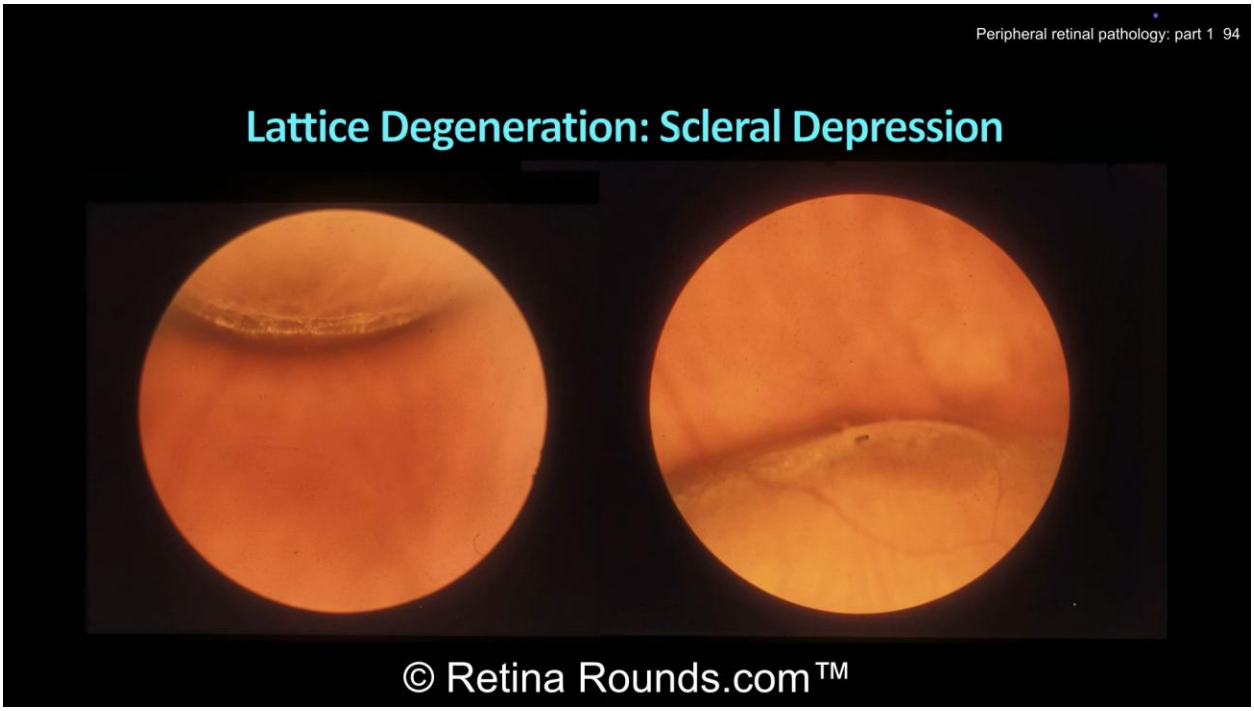
It's important to remember that vitreoretinal adhesions are very tight at the edge of lattice. In this histopathology slide, the central excavation represents a scalloped area of atrophy within an area of lattice degeneration. The red arrows point to the edge of lattice where you can see vitreous remnants adherent at the edge. When performing vitrectomy for lattice associated retinal detachments, it's important to elevate the vitreous 360° around the area of lattice and to trim the vitreous remnants down at the edge. Pulling too hard on the overlying vitreous may result in larger or additional retinal breaks.



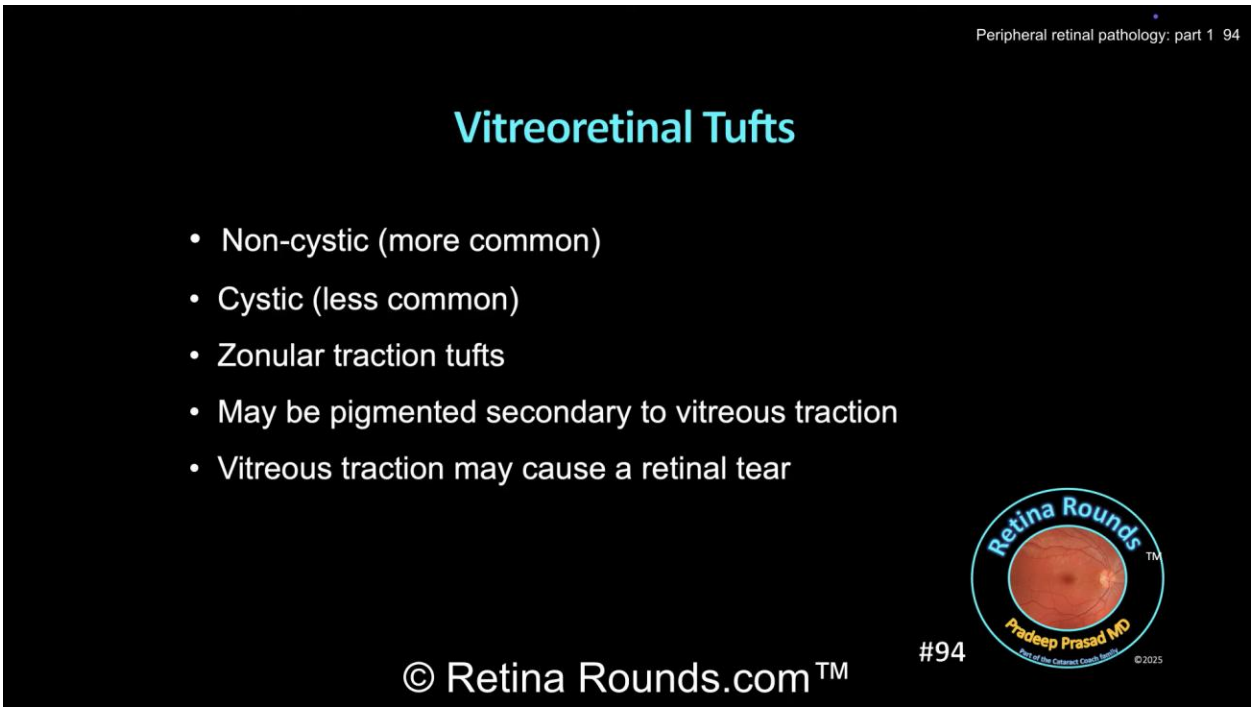
This slide also demonstrates the tight vitreoretinal adhesions that are present at the edge of an area of lattice degeneration.

And here we can see a bursa of liquefied vitreous overlying an area of lattice degeneration which is a typical anatomic finding.

Now scleral depression can help not only to visualize lattice but oblique viewing may also help to identify subtle holes or tears that otherwise might be missed especially in patients with the blonde fundus.



Next, we'll discuss vitreoretinal tufts. You can see in this photo two discrete tufts or excrescences of the retina which have a gliotic appearance and a hyperpigmented rim.



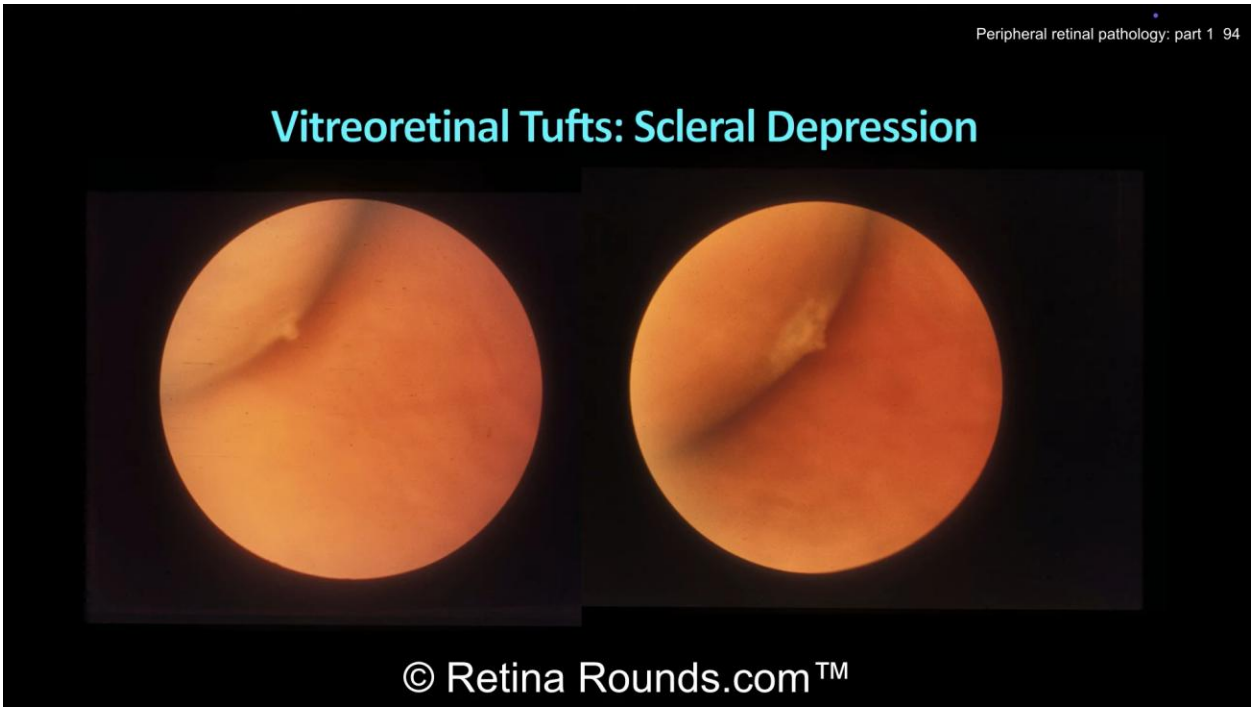
Retinal tufts can be characterized as non-cystic which is the more common variety or cystic which is less common and has cavitations within the tuft and zonular traction tufts which appear as thin strands of tissue that can extend anteriorly from the ciliary body to the retinal surface. Vitrial adhesions are tight with vitreoretinal tufts and traction exerted by the vitreous may result in a hyperpigmented lesion or hyperpigmented borders. Vitreous traction on these lesions can also result in retinal tears.

Here's another vitro retinal tuft which appears posterior to the vitreous space and has variable degrees of hyperpigmentation.

Excessive vitreoretinal traction on these lesions may result in an operculated retinal hole as is shown here. Now while retinal detachments may occur these are lower risk lesions than flap tears for example since the vitreoretinal traction has been relieved.

Here's another photo of a small operculated hole associated with a vitreoretinal tuft.

Here's a histopathology slide demonstrating the gliotic expression emanating from the retina and it's faint but you can see hyoid remnants that appear to be still attached at the apex of the tuft.

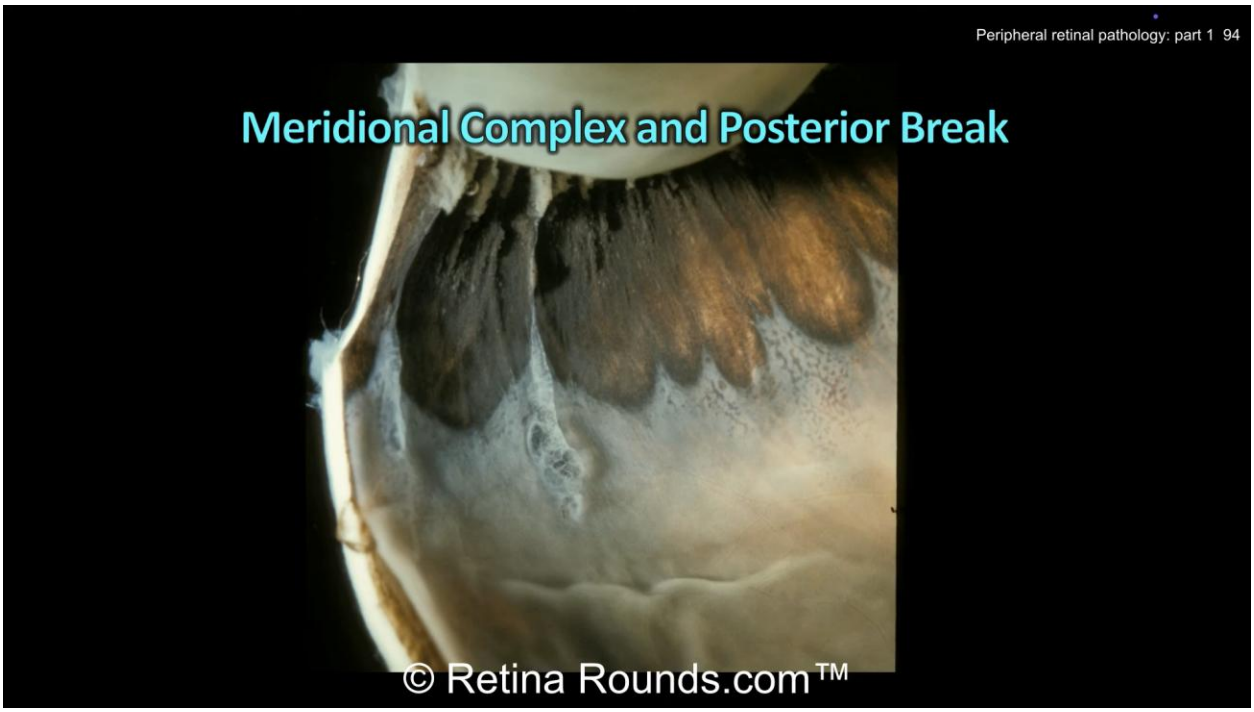


Vitreoretinal tufts may be small and difficult to identify. Scleral depression can help better visualize these lesions when viewed from an oblique angle. This can also help to identify cystic spaces within the tuft and help distinguish tufts associated with cystic changes from those with small associated retinal breaks.

Here's a different peripheral lesion. This is a meridional complex. Now a meridional fold is a plate of retinal tissue that's typically present at the ora serrata. A meridional complex on the other hand is a meridional fold that is in line and integrated with the dentate process and the associated ciliary process.

Now breaks tend to occur at the posterior edge of these lesions and it is thought to be due to abnormal vitreoretinal traction. Here you can see three meridional complexes all associated with small posterior retinal breaks

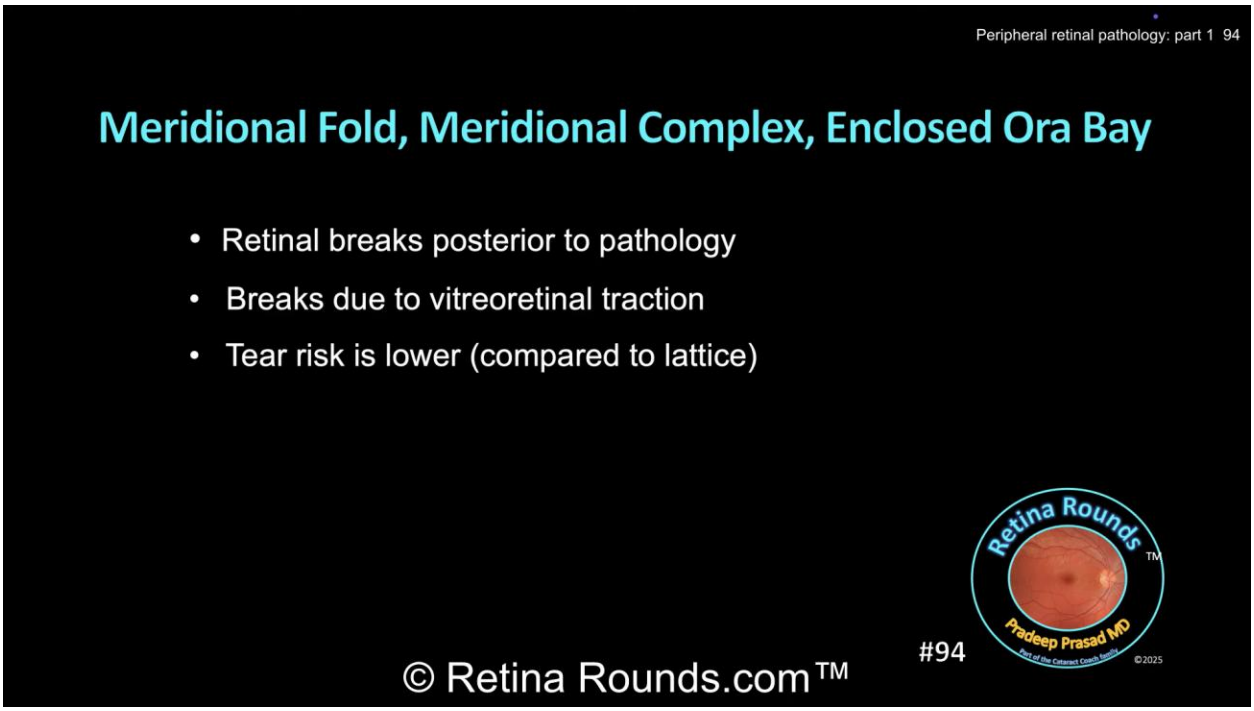
An ora bay is the scalloped area between dentate processes and sometimes retinal tissue may coalesce anteriorly to the bay forming an enclosed ora bay. Here we have an interesting finding of an enclosed ora bay associated with a meridional complex and a small retinal break just posterior to the enclosed ora bay.



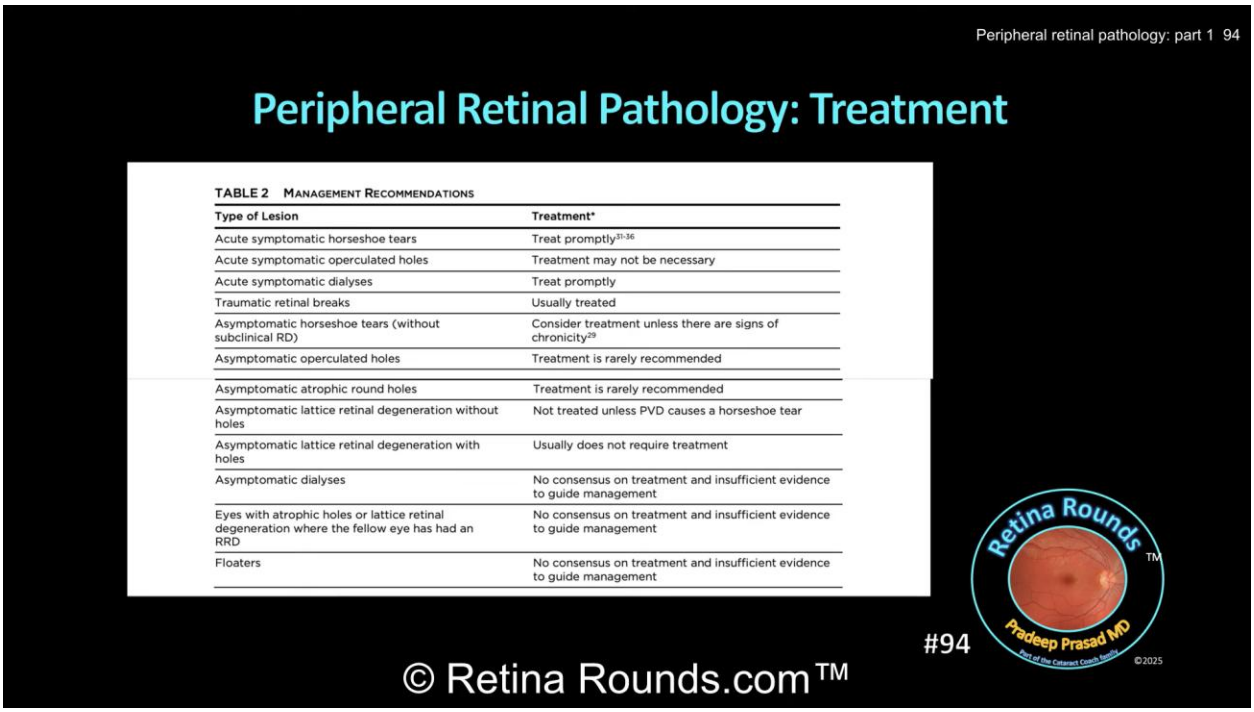
Sometimes a meridional fold part of a meridional complex may have associated cystic spaces as is shown in this photo.

Now here you can see two meridional complexes both associated with smaller percolated retinal holes just posteriorly.

And here we have a meridional fold which is in an ora bay between two dentate processes. You can see a small flap tear at the posterior edge of the meridional fold.



So again, meridional folds complexes and enclosed aura bays all may be associated with retinal breaks that usually appear just posterior to these areas of pathology. Breaks are thought to be due to abnormal vitreoretinal traction and tears associated with these lesions appear to be less frequent than for example tears associated with lattice degeneration.

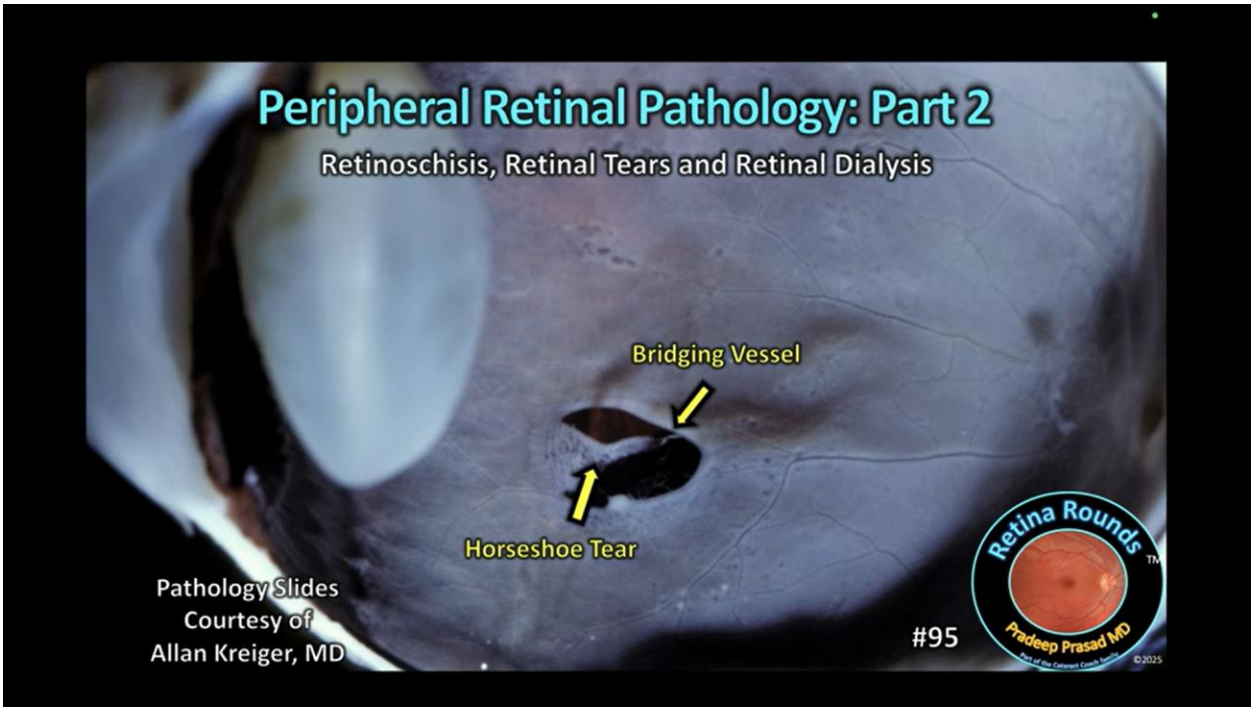


Now once you've identified peripheral pathology that may predispose to a retinal tear what should we do about it. Now this table was taken from the recent AAO preferred practice patterns

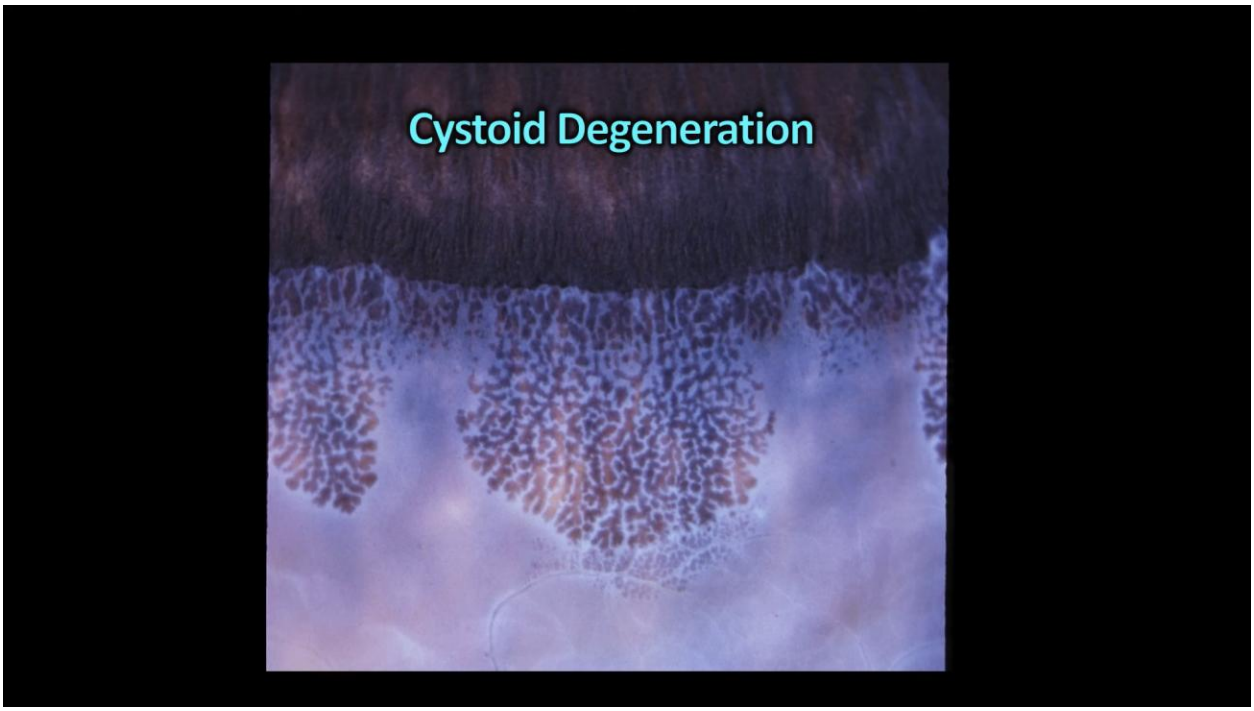
publication. And we'll come back to retinal tears in our next episode but let's focus on the AAO's recommendation regarding lattice degeneration. It says here for asymptomatic lattice without holes the AAO recommends observation unless a PVD causes a retinal tear. Even for lattice degeneration with holes the AAO recommends that treatment is usually not required. Now while this is a reasonable approach given the relatively low rate of retinal detachment associated with atrophic holes compared to lattice degeneration with a retinal tear for example, I would like to hear what the retina rounds community thinks about prophylactic treatment. Now modern lasers can be quite gentle with low rates of inflammation and ERM formation. My general approach given that I've treated many retinal detachments secondary to atrophic holes is to recommend prophylactic treatment of these areas since the benefit may outweigh the risk. Now for asymptomatic lattice degeneration without associated holes or detachments, I generally observe and educate patients on the importance of urgent evaluation should they experience a sudden increase in floaters or flashes. I also recommend treatment of lattice even when asymptomatic if the patient has had a retinal detachment in the fellow eye, and this is generally the same approach I take for other peripheral lesions that may predispose to retinal detachment.

- **Peripheral Retinal Pathology: Part 2**

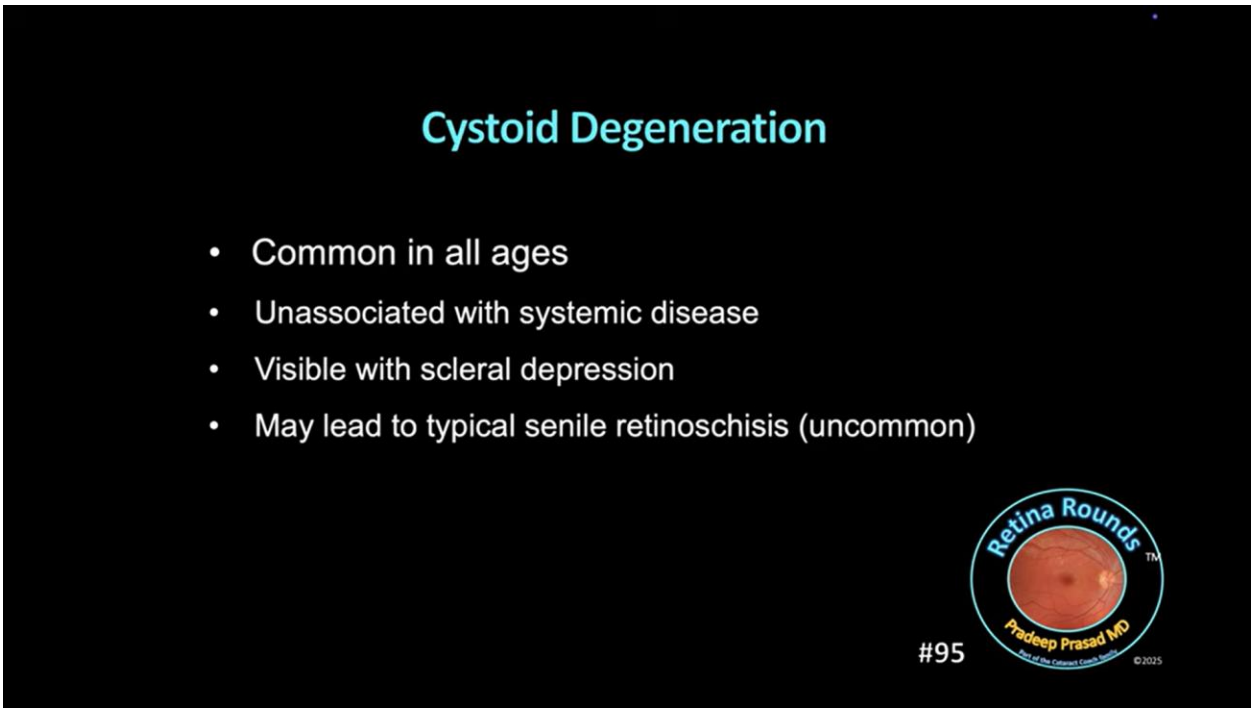
Link: https://www.youtube.com/watch?v=puQpovxof0k



Peripheral retinal pathology part two continue our anatomic review of peripheral retinal pathology. In today's episode we'll cover retinoschisis, retinal tears and retinal dialysis these are all lesions that can lead to retinal detachment and we'll not only cover the anatomic features but also management recommendations.

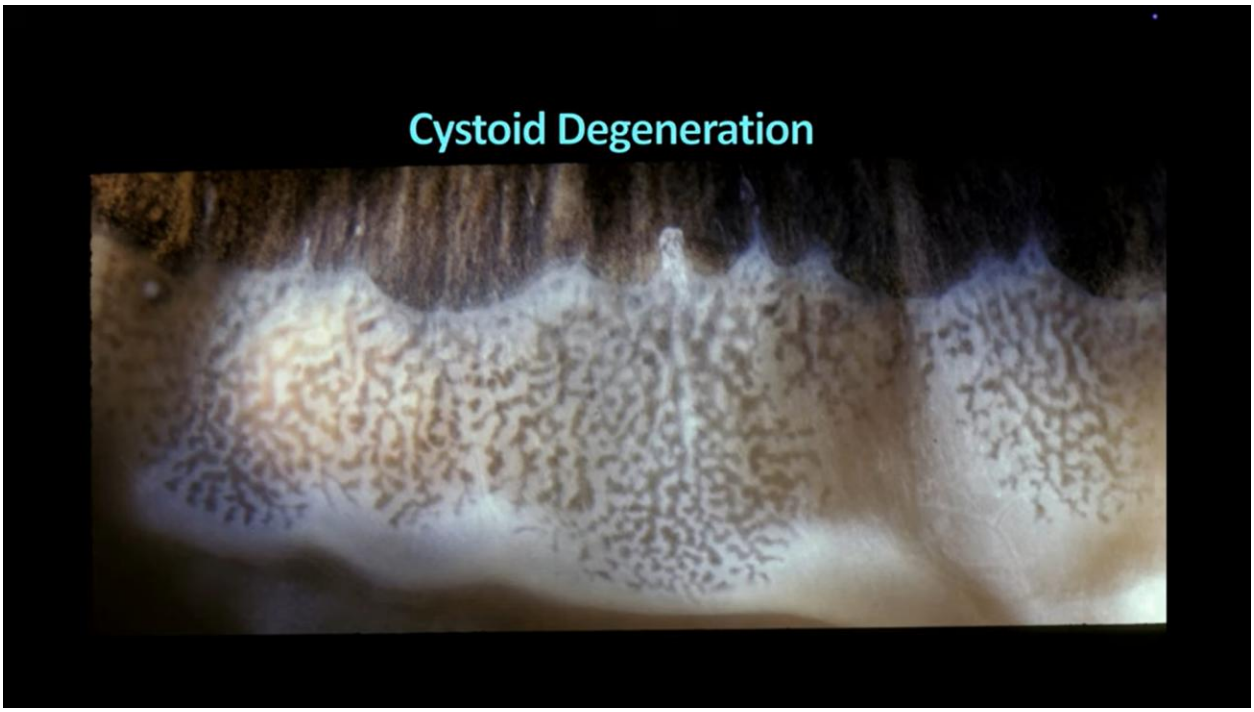


Before we talk about retinoschisis we should start by discussing lesions that can lead to retinoschisis. Here's an example of peripheral cystoid degeneration which is typically located proximal to the ora serrata and has a dimpled appearance.

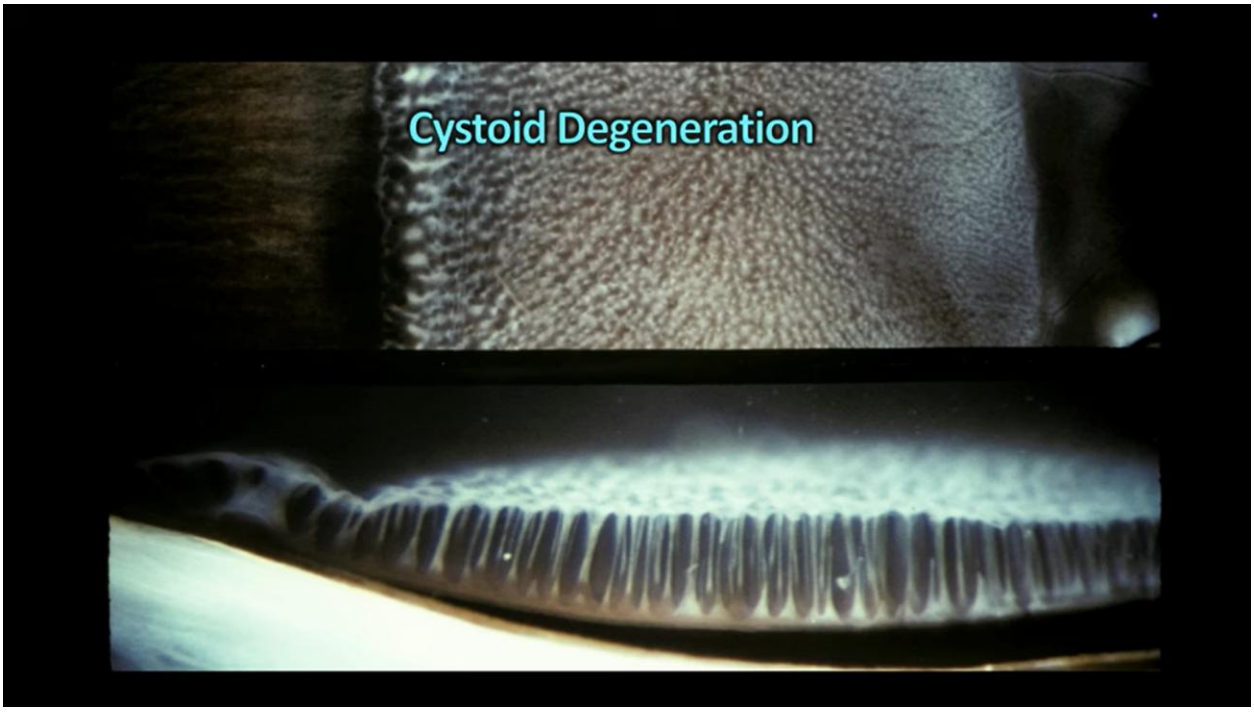


Peripheral cystoid degeneration is common in all ages and is unassociated with systemic disease. Given its peripheral location it's best visualized with scleral depression and anatomically cystoid

degeneration is characterized by cyst-like spaces in the outer plexiform layer. Uncommonly these areas can coalesce leading to typical degenerative or senile retinoschisis.

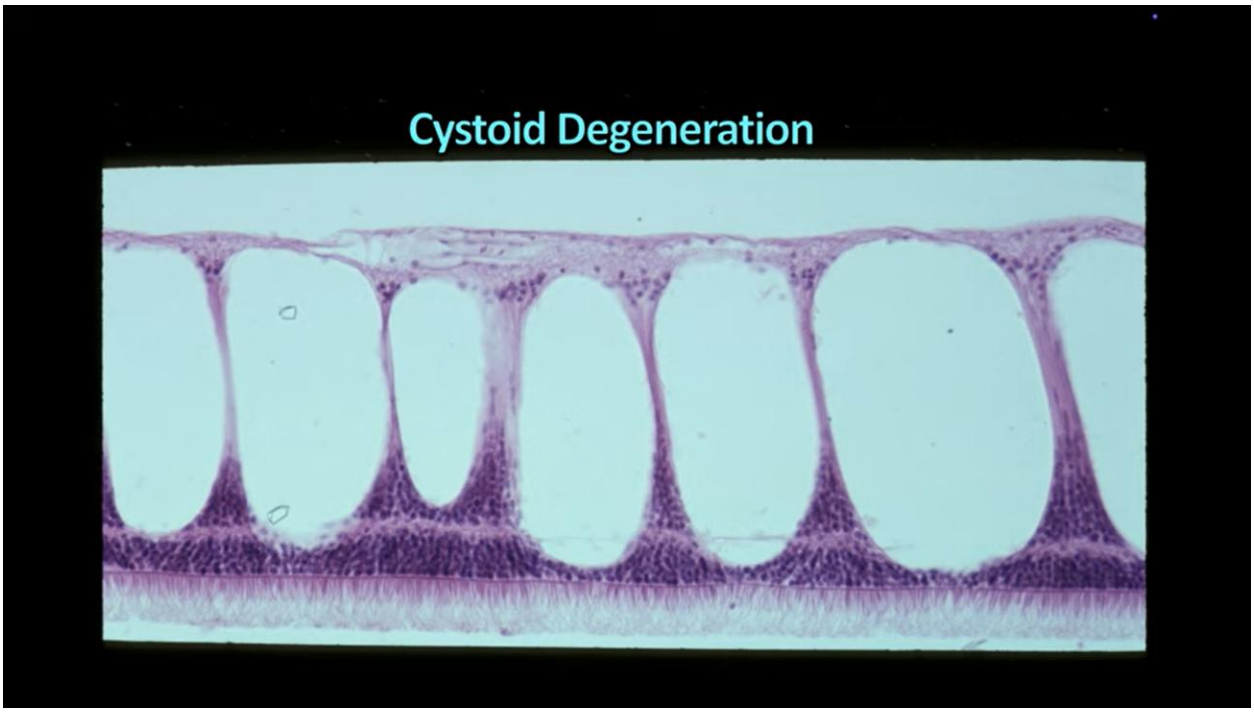


Here's another example of a broader area of cystoid degeneration located in the peripheral retina near the ora serrata.

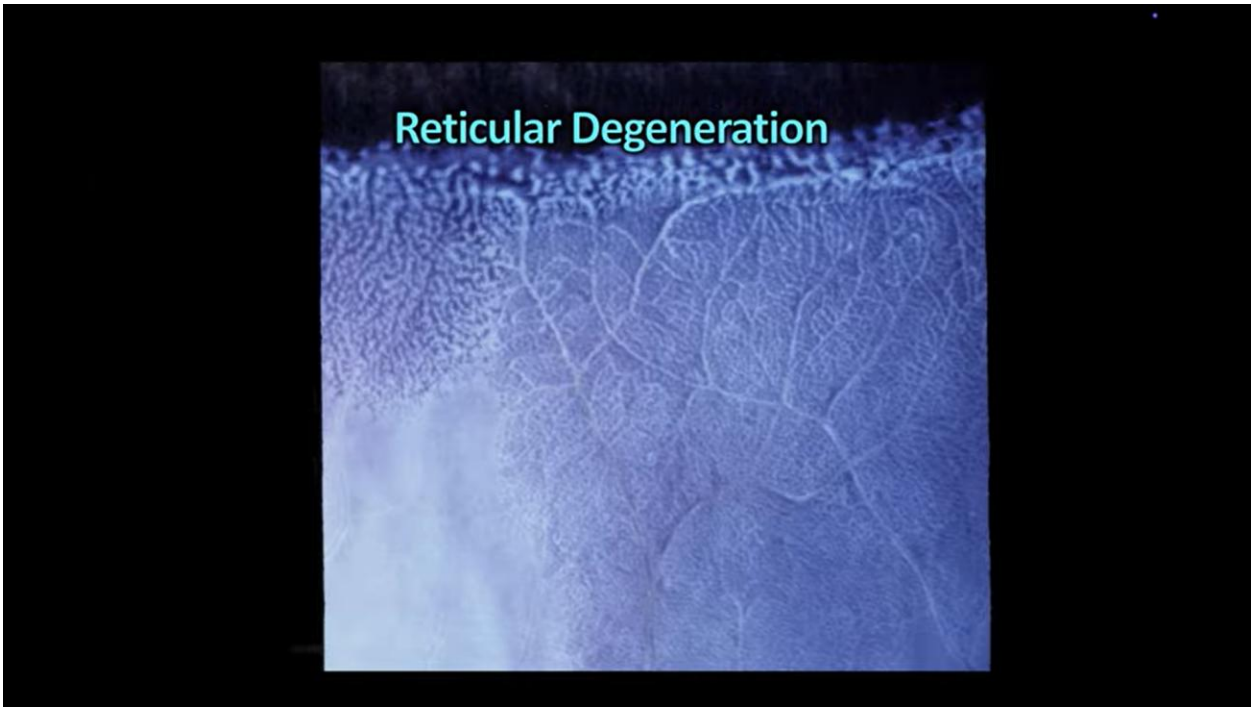


In the top image here we can see another example of cystoid degeneration and the bottom image

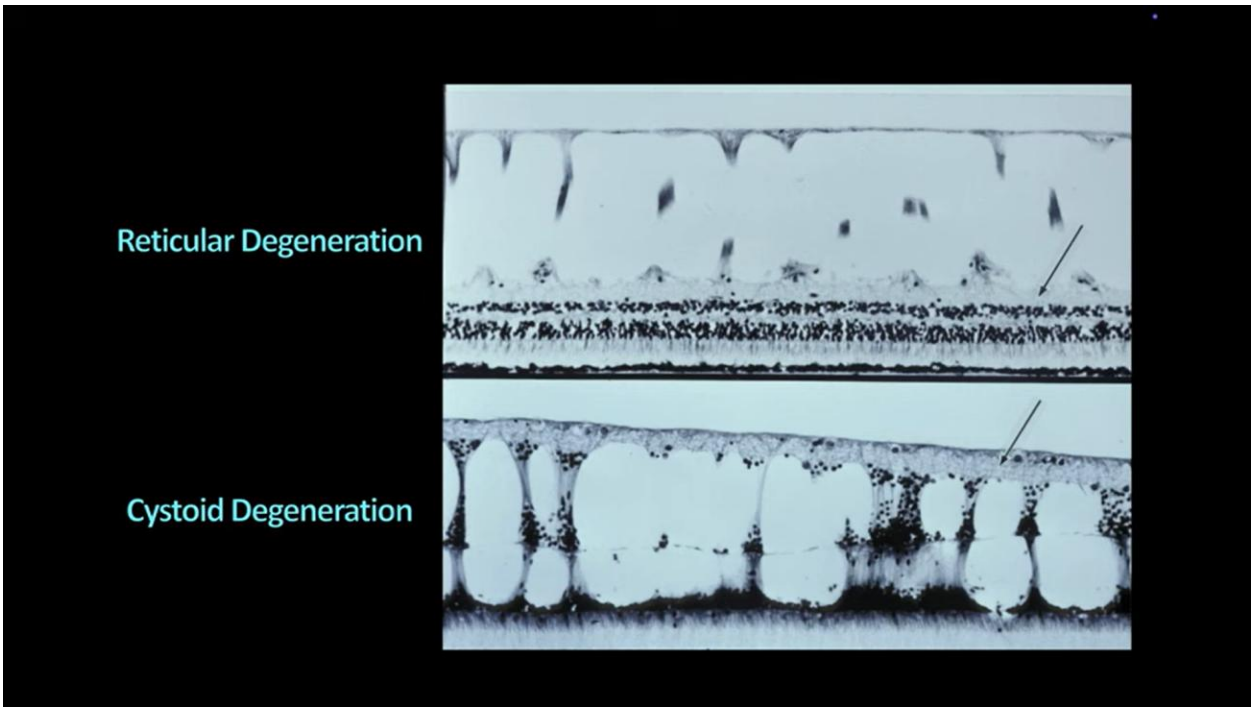
shows a cross-sectional image demonstrating the cyst-like spaces that give its characteristic appearance.



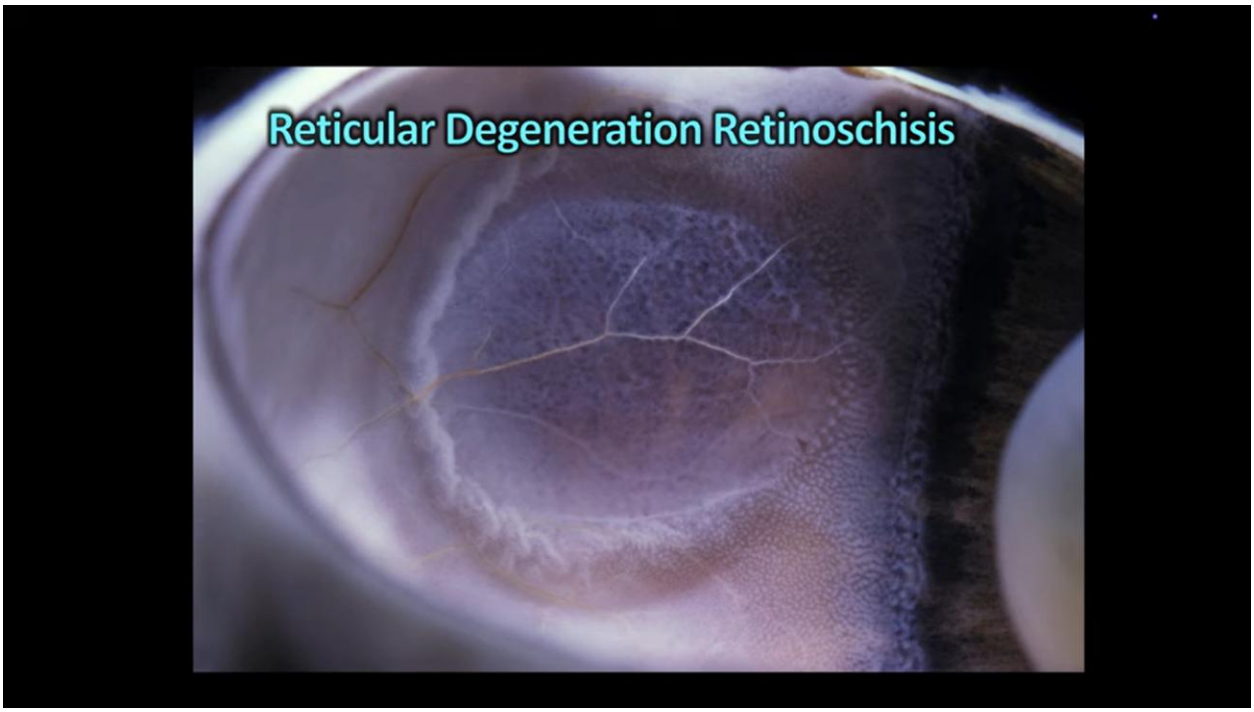
Here's a histopathology slide demonstrating these cyst-like spaces localized to the outer plexiform layer.



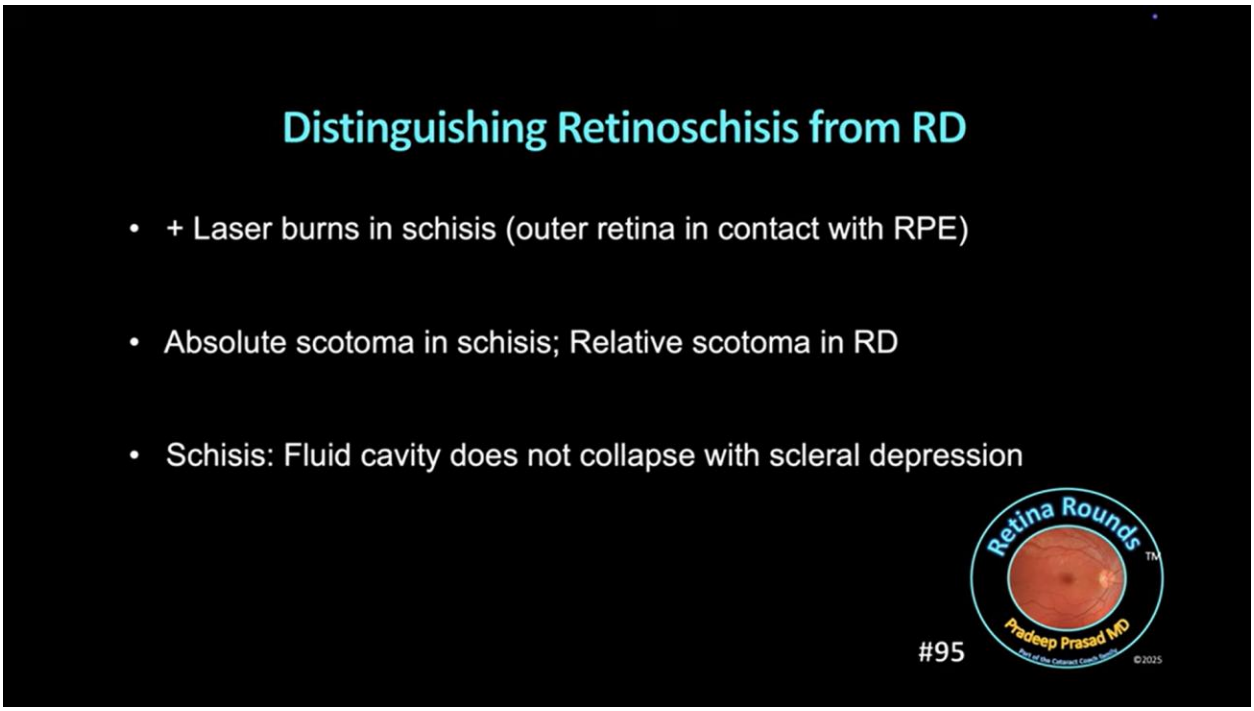
Here we can see an area of reticular degeneration which has a more lacy appearance and is characteristically posterior to an area of cystoid degeneration.



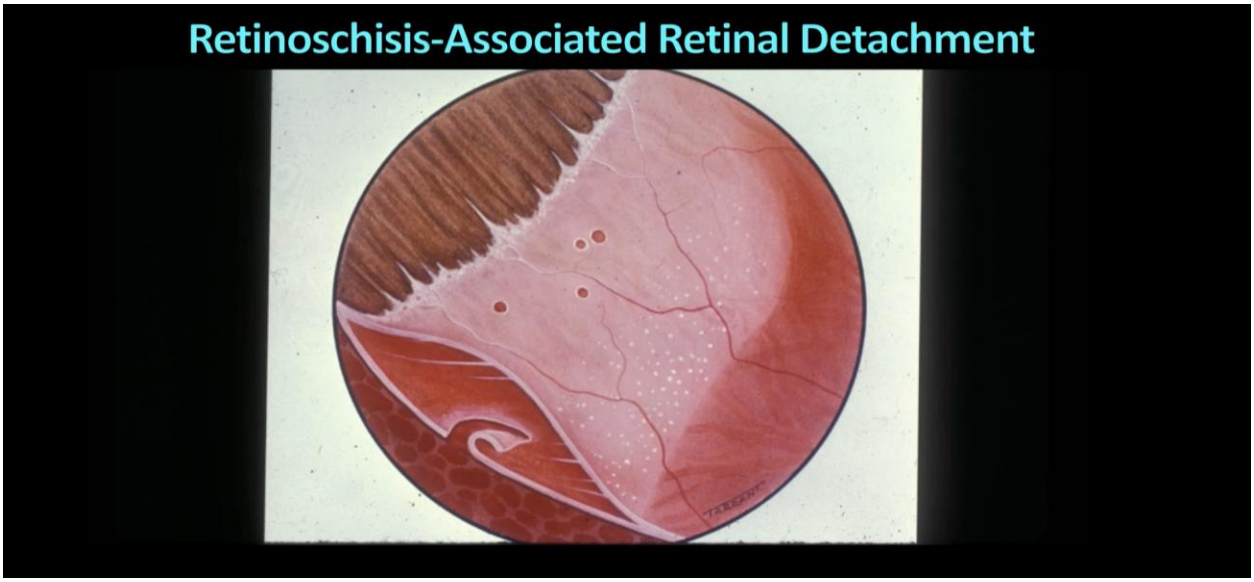
Reticular degeneration anatomically localizes to the nerve fiber layer which can be seen in the upper slide as opposed to cystoid degeneration in the lower slide which localizes to the outer plexiform layer.



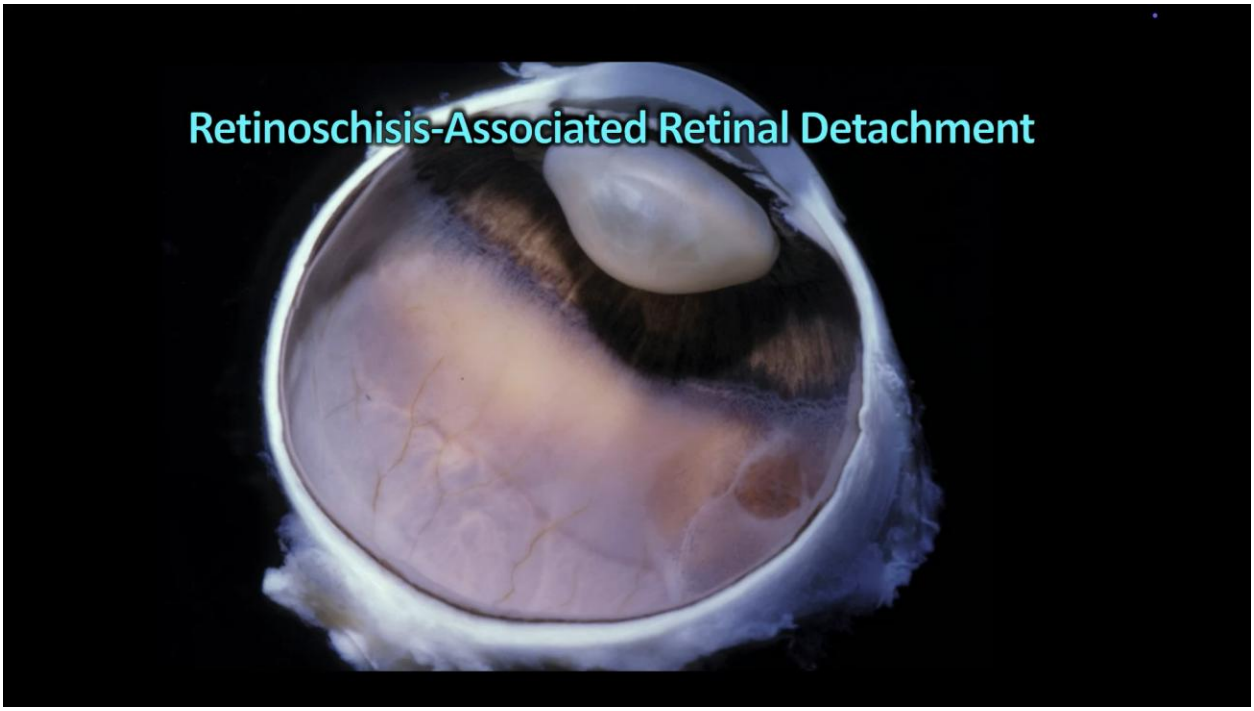
Cystic spaces and reticular degeneration can coalesce to yield reticular retinoschisis. Reticular retinoschisis is usually more bolusly elevated and more often can progress posteriorly.



It can be difficult at times to differentiate retinoschisis from retinal detachment. Here are a few tips to distinguish the two: Application of laser to an area of retinoschisis will result in blanching of the retina since the outer retina is still in contact with the RP. Retinal detachments on the other hand will not blanch with laser. Retinoschisis results in an absolute scotoma since there is a disconnection between the outer retina and inner retina. Whereas retinal detachments are associated with the relative scotoma since the layers of the retina are still intact. Lastly with scleral depression schisis cavities do not collapse rather the schisis cavity moves in union with scleral depression. Scleral depression of retinal detachments on the other hand will result in the RPE being brought towards the detached retina and in cases of a relatively shallow detachment opposition of the RPE to the overlying detached retina.



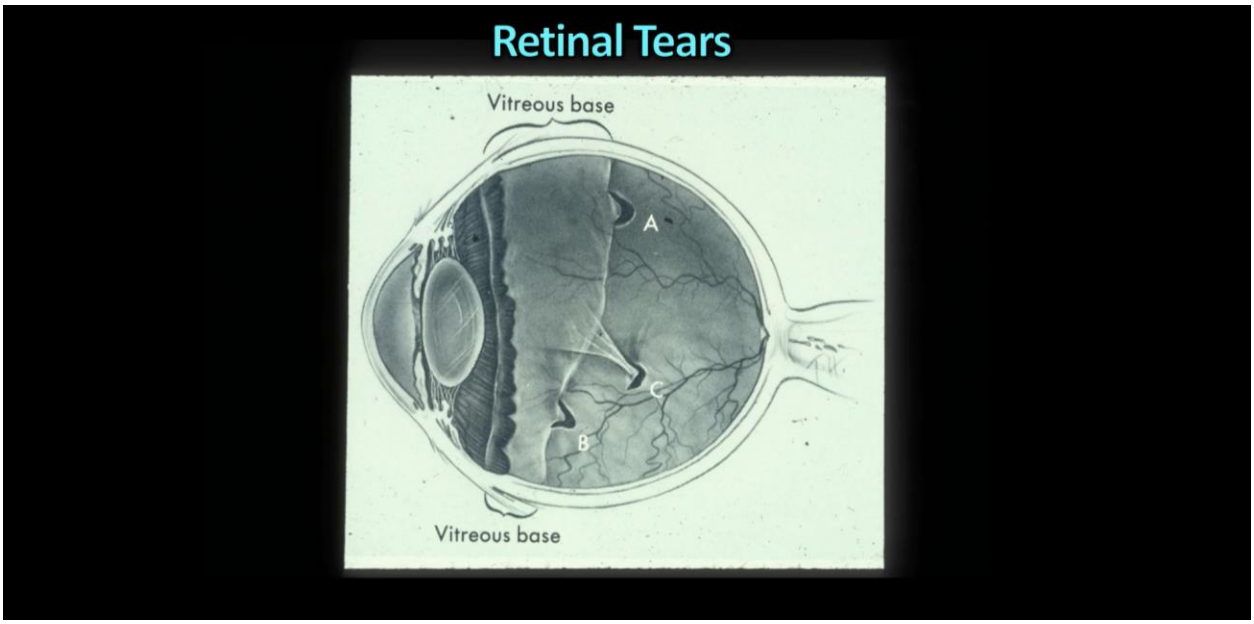
Retinoschisis can be associated with a retinal detachment and this generally occurs due to the presence of inner wall breaks that allow liquefied vitreous to flow into the schisis cavity and outer retinal breaks that allow fluid from the schisis cavity to flow into the subretinal space.



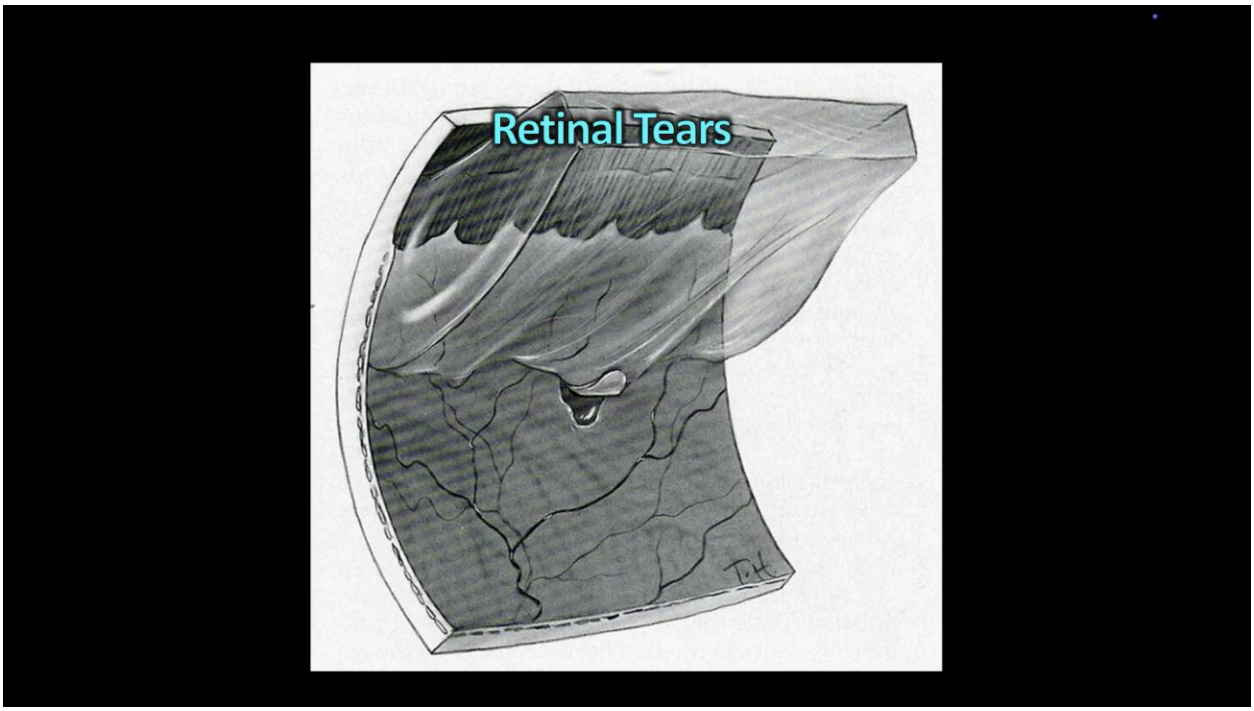
Here's an example of a schisis associated retinal detachment. You can see the thin almost translucent layers of the inner retina.

Here's another schisis retinal detachment and you can see the small inner wall breaks on the bolus’s cavity.

It's important to note that schisis retinal detachment repair can be achieved solely by closing the outer wall break. Here you can see a scleral buckle that has closed a large outer wall retinal break and while apposition of the RPE to the outer retina can fix a retinal detachment, untreated inner wall breaks can still allow schisis cavities to expand.



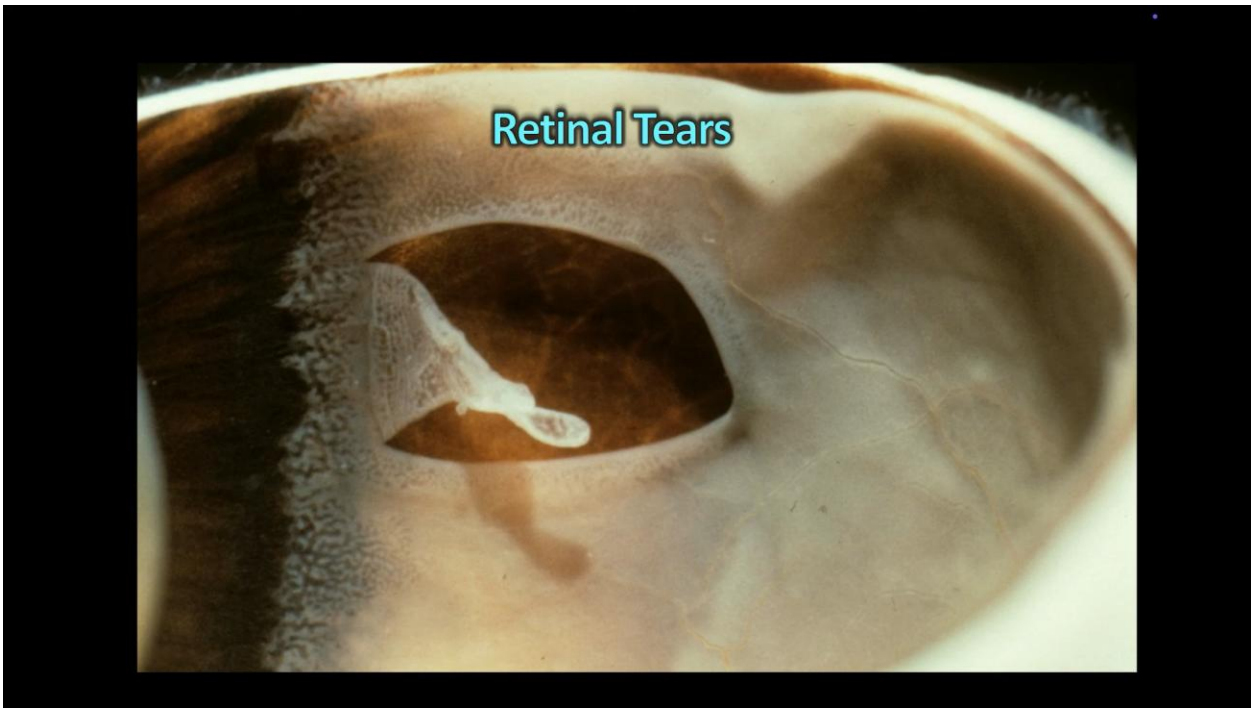
Okay let's move on to retinal tears and we've shown you previously in episode 64 that retinal tears typically occur at the posterior edge of the vitreous base. However, vitreous traction can also extend beyond the base to create more posterior retinal breaks.



Here's another image demonstrating how a PVD can result in a retinal break at an area of tight vitreal adhesion.

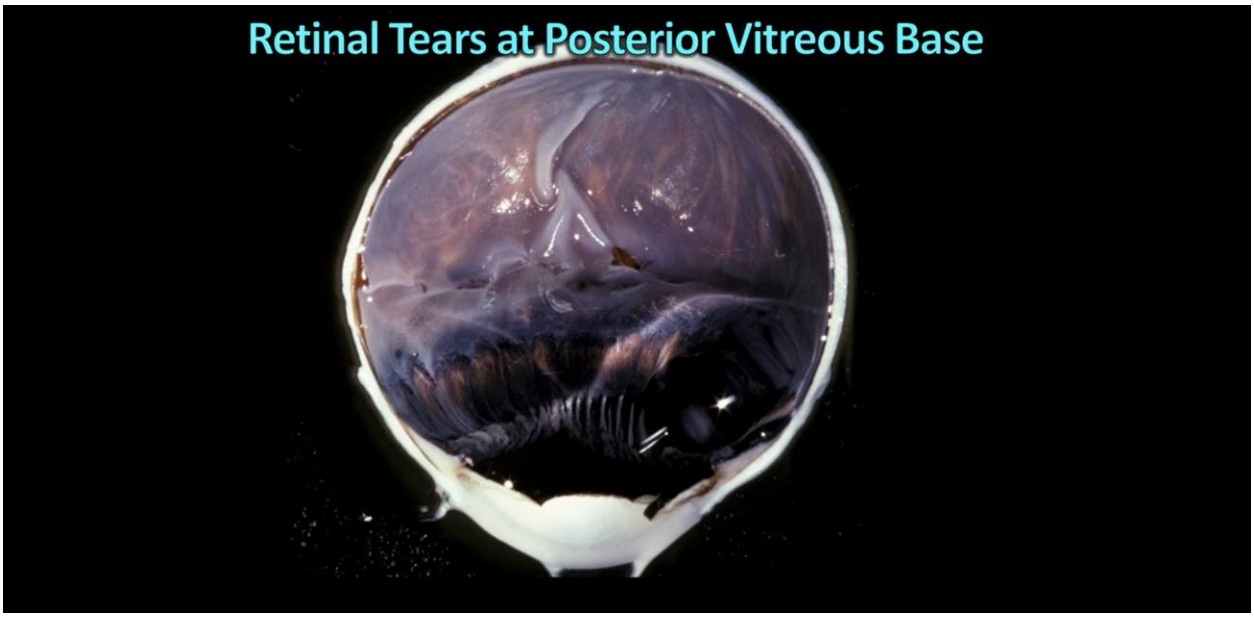
Retinal tears have a flap or horseshoe like configuration with residual vitreous traction being exerted on the flap of the brake. Surgically this traction can be relieved either with a scleral buckle or by lysing the vitreal adhesions during vitrectomy.

This is in contrast to an operculated retinal hole where vitreous traction avulses a piece of retina. Since vitreous traction is no longer being exerted on the break, these retinal breaks have a lower likelihood of progressing to a retinal detachment.

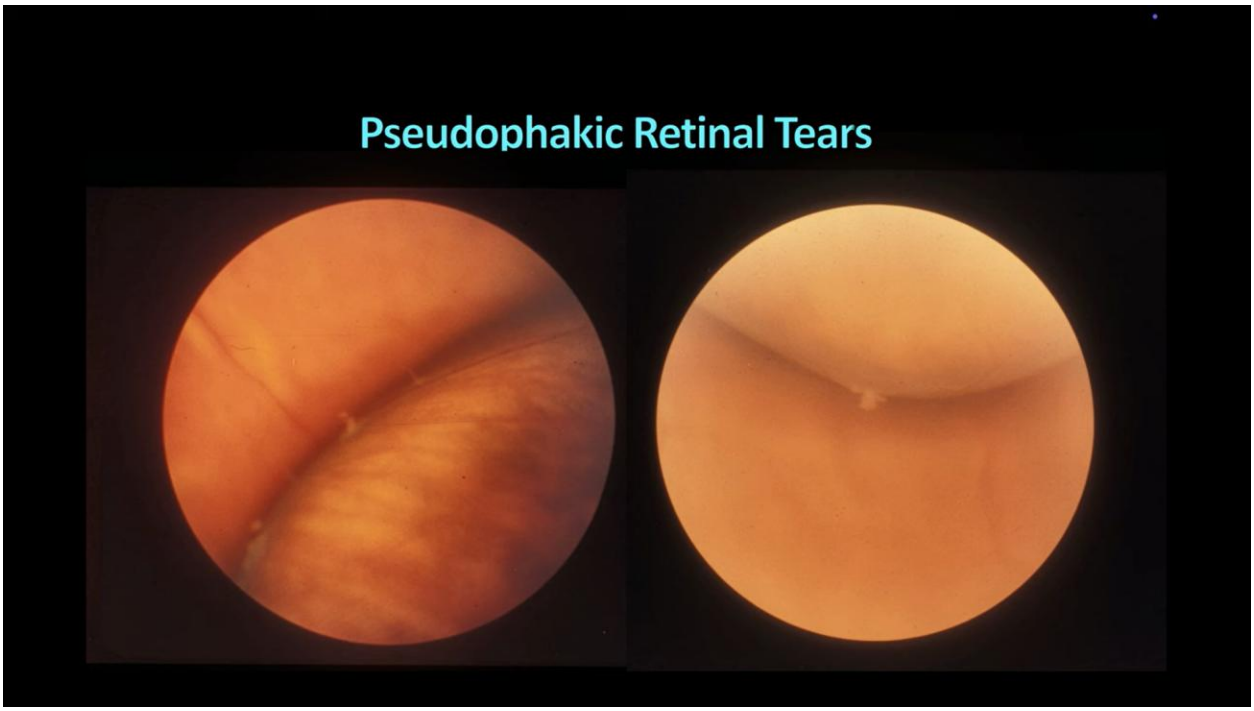


A retinal tear can also be larger and extend most more posteriorly as is demonstrated here.

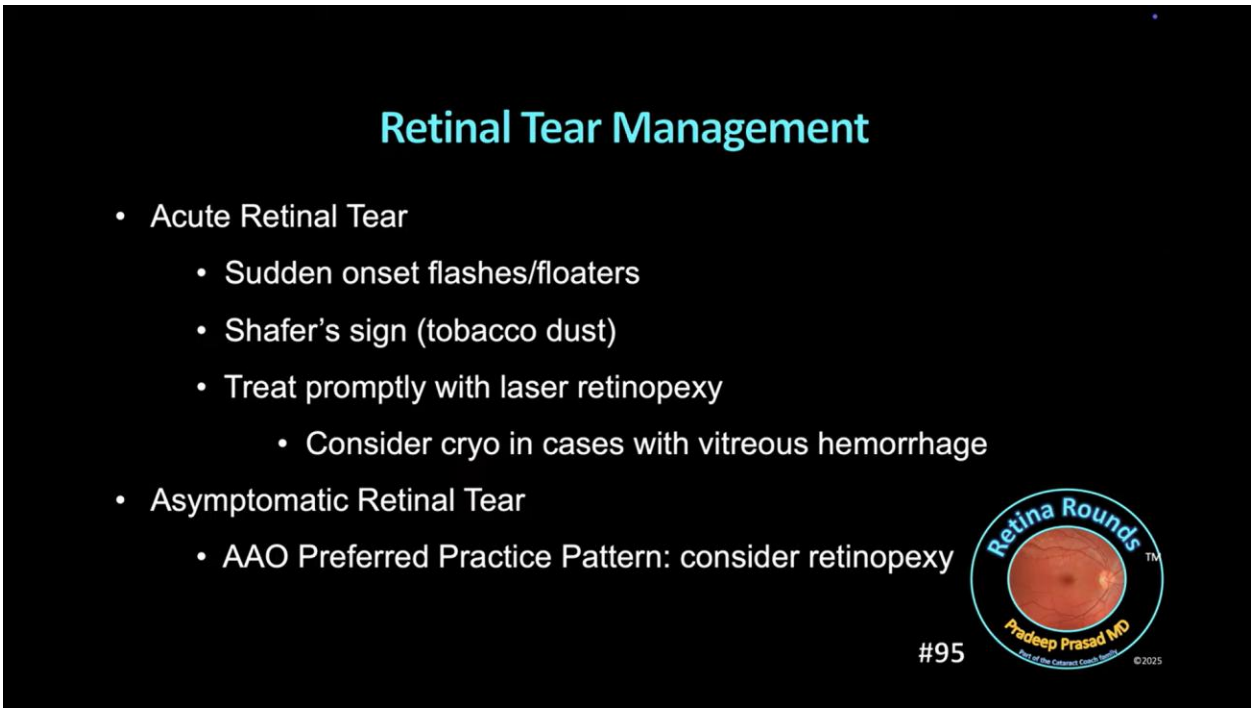
Retinal tears can also occur near retinal vessels. In this picture a bridging retinal vessel can be seen extending from the flap tear posteriorly. These retinal breaks can be associated with vitreous hemorrhage if the vessel is broken.



In this pathology specimen of an eye hung with a cornea pointed down you can see the residual vitreous moving towards the front of the eye and is associated with multiple tears at the posterior edge of the vitreous base.

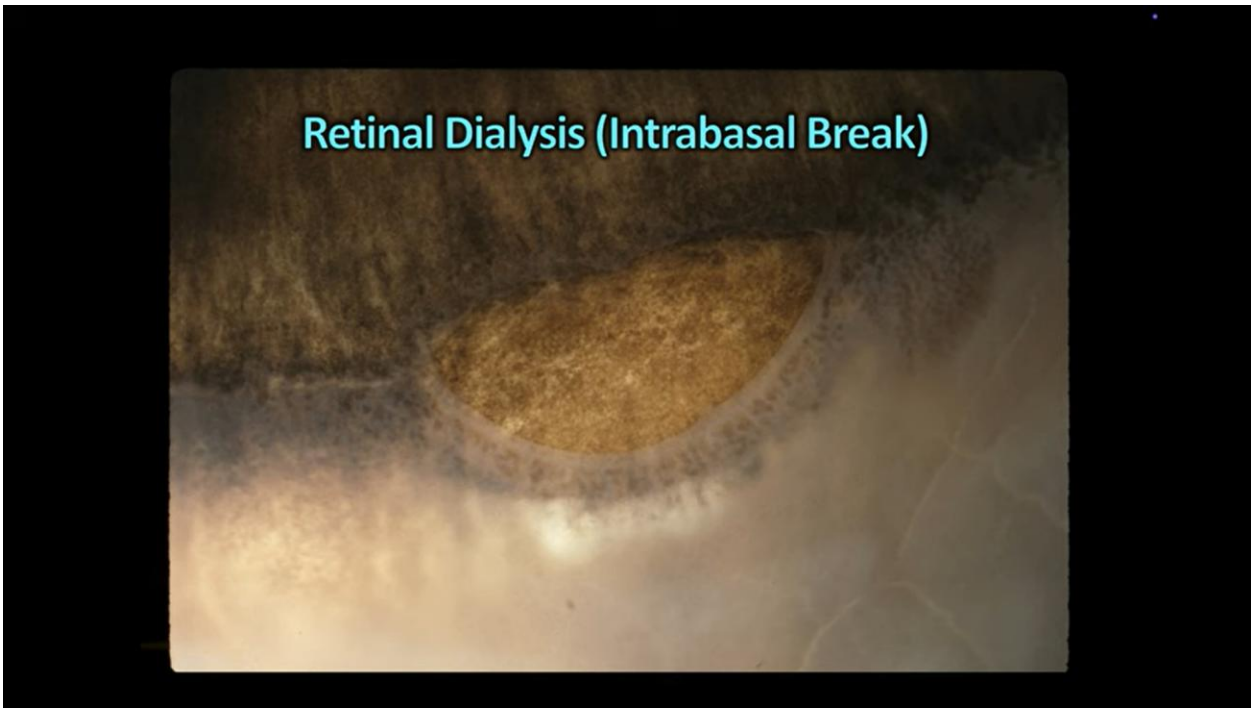


Sometimes retinal breaks can be quite small and are only visible obliquely with scleral depression. In these examples the smaller triangular shaped breaks can often be seen in pseudophakic retinal detachments.

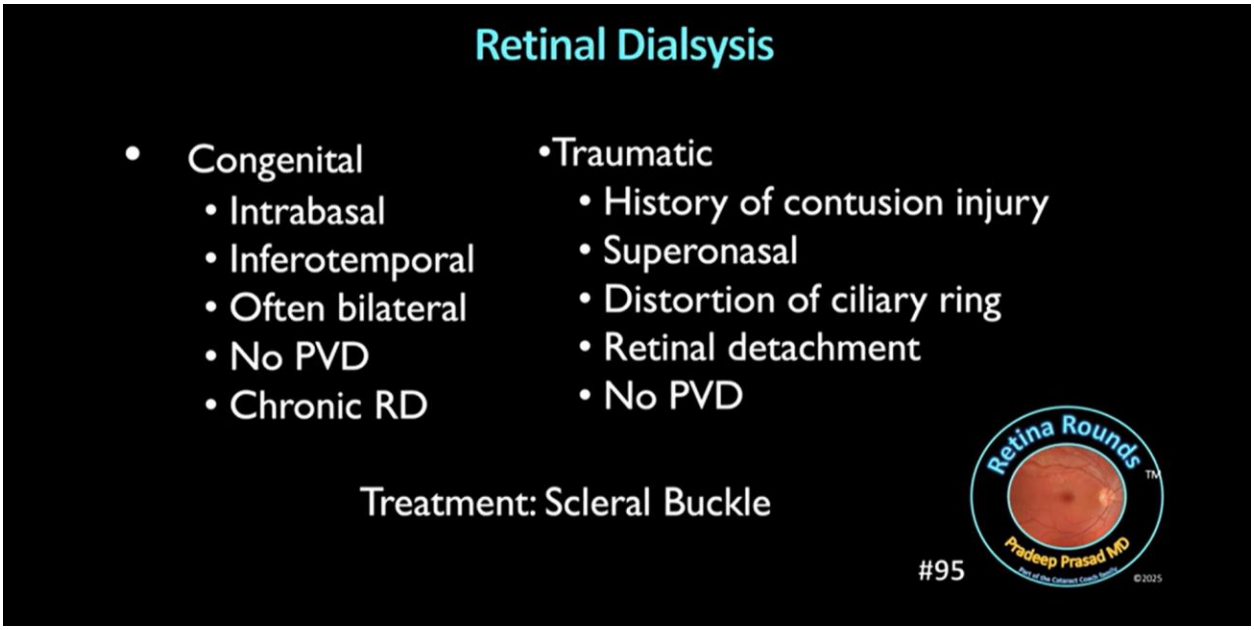


Now generally speaking acute retinal tears are associated with a PVD and symptoms may include a sudden onset of flashes and floaters. Examination of the anterior vitreous in patients with a retinal tear or detachment may reveal small granules of liberated RPE which looks like tobacco

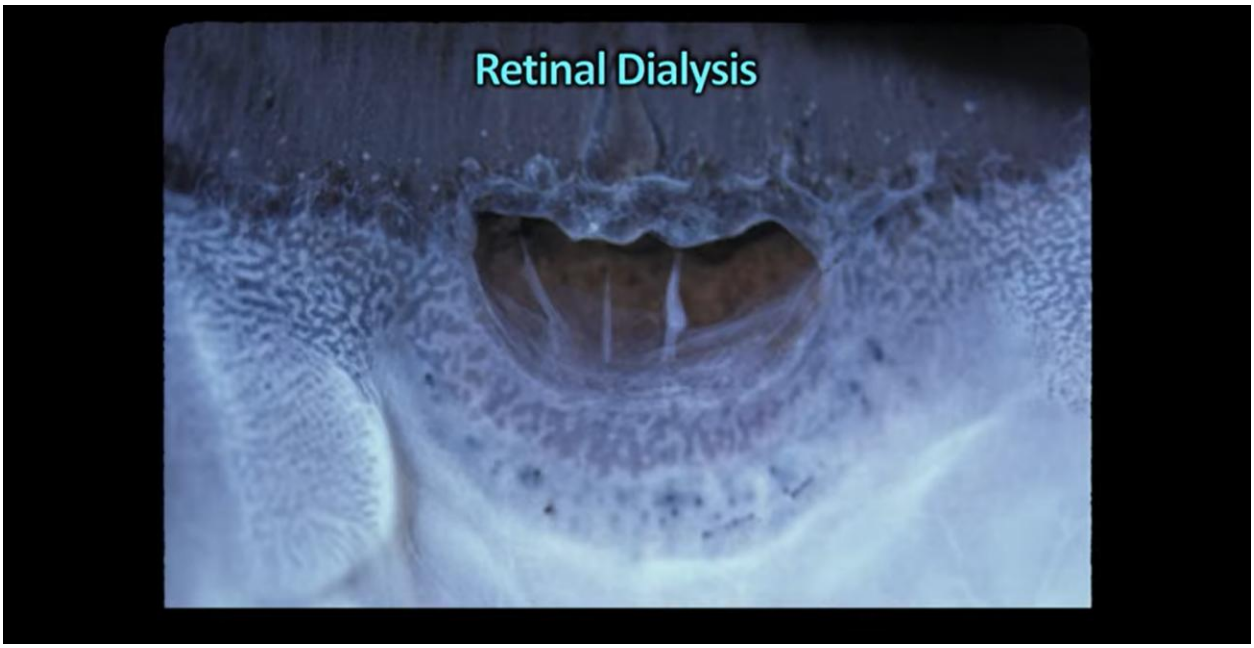
dust the so-called Schaefer sign. Typically, acute retinal tears should be treated promptly with laser retinopexy although cryo can also be considered if vitreous hemorrhage obscures the view for treatment with laser. The AAO preferred practice patterns call for consideration of retinopexy in cases of asymptomatic retinal tears although my general approach is to treat these lesions promptly as well.



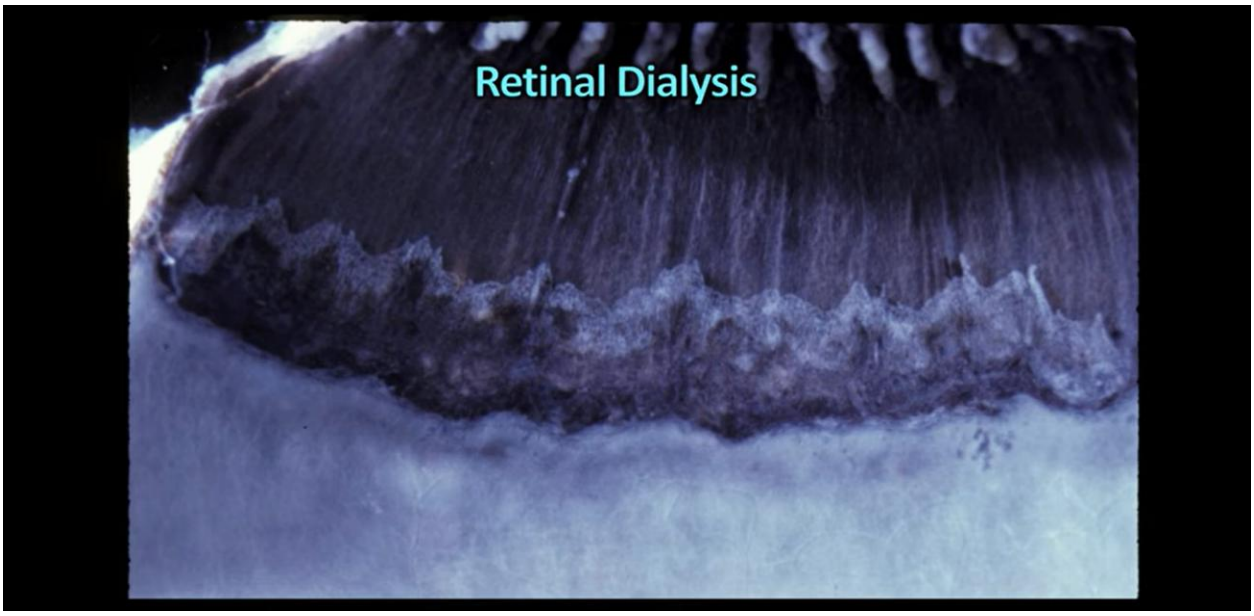
Last let's talk about retinal dialysis. A retinal dialysis is a retinal break that is located within the vitreous base rather than posterior to or distal to the vitreous base.



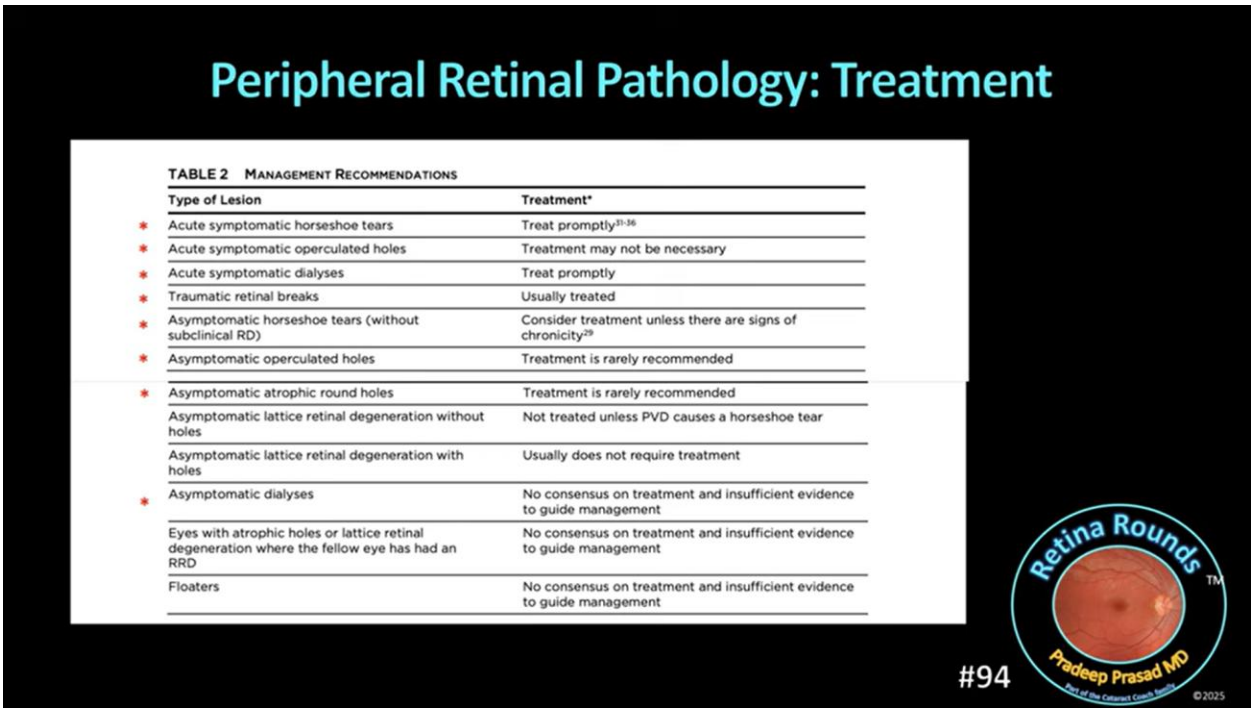
A retinal dialysis may be congenital or traumatic. Congenital retinal dialyses are typically inferotemporal, often bilateral and associated with a chronic retinal detachment without a PVD. A pigmentary demarcation line may be seen in these chronic retinal detachments. Traumatic retinal dialysis on the other hand occur as a result of contusion injury to the globe, are usually superonasal, and are caused by traumatic distortion of the ciliary ring. Traumatic dialysis can also lead to a non-PVD associated retinal detachment. It should be noted that retinal detachments associated with retinal diialysis are optimally treated with scleral buckles since they have a very high success rate.



Here's an example of a retinal diialysis located just posterior to the ora serrata within the vitreous base and within an area of cystoid degeneration.



And here's another broader retinal diialysis and you can see the break in the retinas just posterior to the ora serrata.

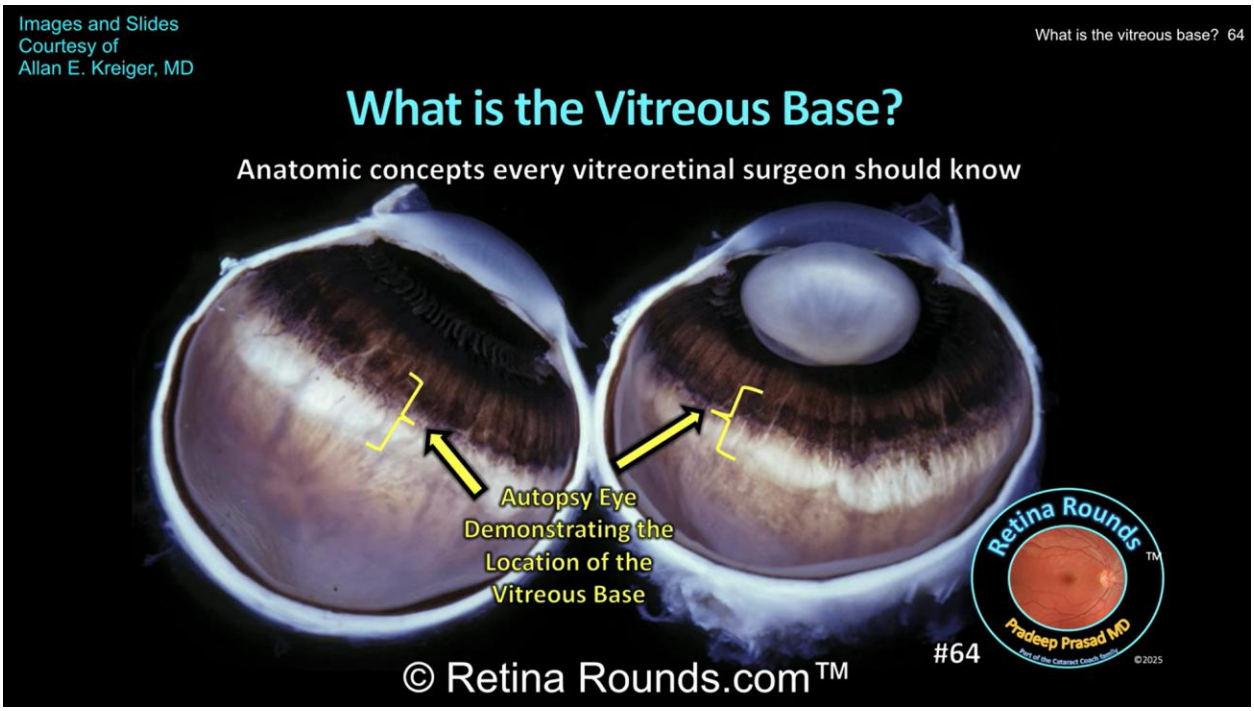


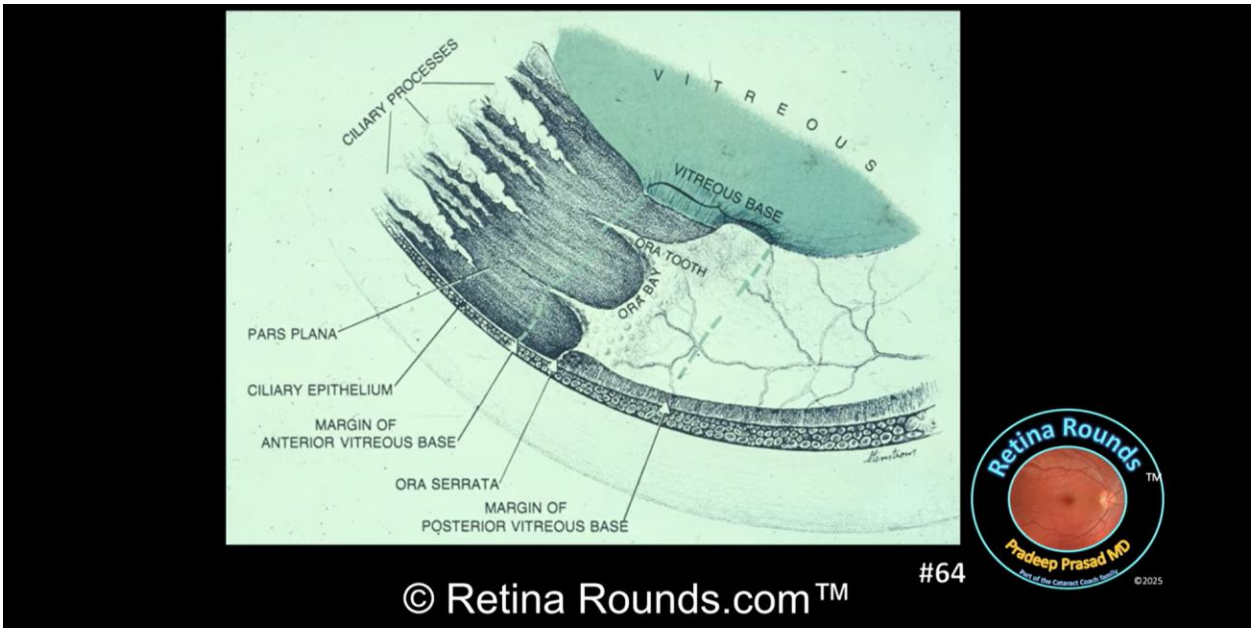
So, here's a review of the management recommendations for retinal breaks taken from the AAO preferred practice patterns. Acute symptomatic horseshoe tears and dialysis should be treated promptly with either laser retinopexy or cryotherapy. Traumatic retinal breaks are also usually treated. But what about breaks that are of lower risk for progression to retinal detachment? According to the AAO, treatment may not be necessary or can be considered for acute symptomatic operculated holes or asymptomatic horseshoe tears without subclinical retinal detachment. Furthermore, asymptomatic operculated holes rarely need treatment and no treatment recommendation is rendered for asymptomatic dialysis. As always, the pros and cons of treatment for these low-risk lesions should be carefully weighed by the physician.

- **What is the Vitreous Base?**

Link: https://www.youtube.com/watch?v=ihGSk-VX628

Every vitreoretinal surgeon should have a good understanding of the vitreous and vitreous base anatomy. In today's episode we will cover the anatomy of the vitreous base, how breaks are associated with the vitreous base and anatomic considerations at the base that can guide surgical decision-making. I want to give a very special acknowledgement to my late mentor Dr. Allan "Buzz" Kreiger for the images and slides presented in this episode. The information presented here is based on his monumental work along with collaborators Dr. Robert Foos and Dr. Bradley Straatsma.



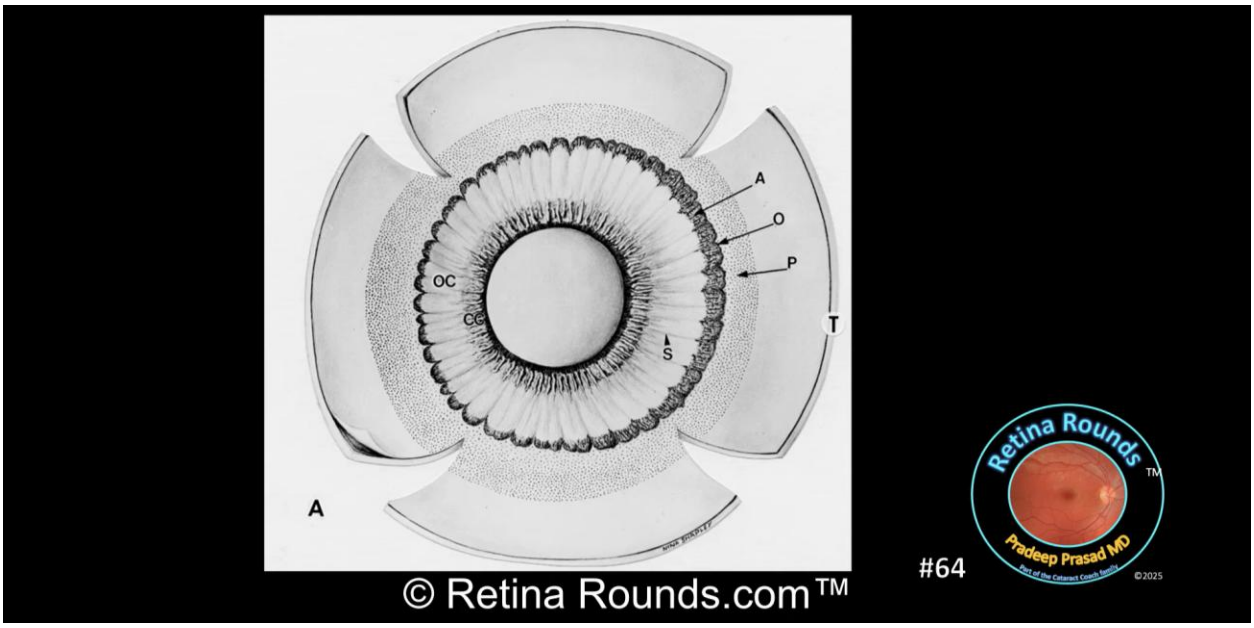


First, we'll start with some basic anatomy of the anterior retina. In this image from left to right we have the ciliary processes followed by the pars plana and ciliary epithelium, this is the safest access point into the vitreous cavity which is posterior to the ciliary body and lens but anterior to the retina. Next, we have the ora serrata which is the anterior most extension of the retina; you can see some toothlike extensions of the retina into the pars plana which are called dentate processes, the scalloped areas between the dentate processes are called ora bays, the vitreous base straddles the ora serrata extends approximately 2 mm anterior and posterior to the serrata and its location is shown in this diagram between the light green dashed lines the collagen fibers

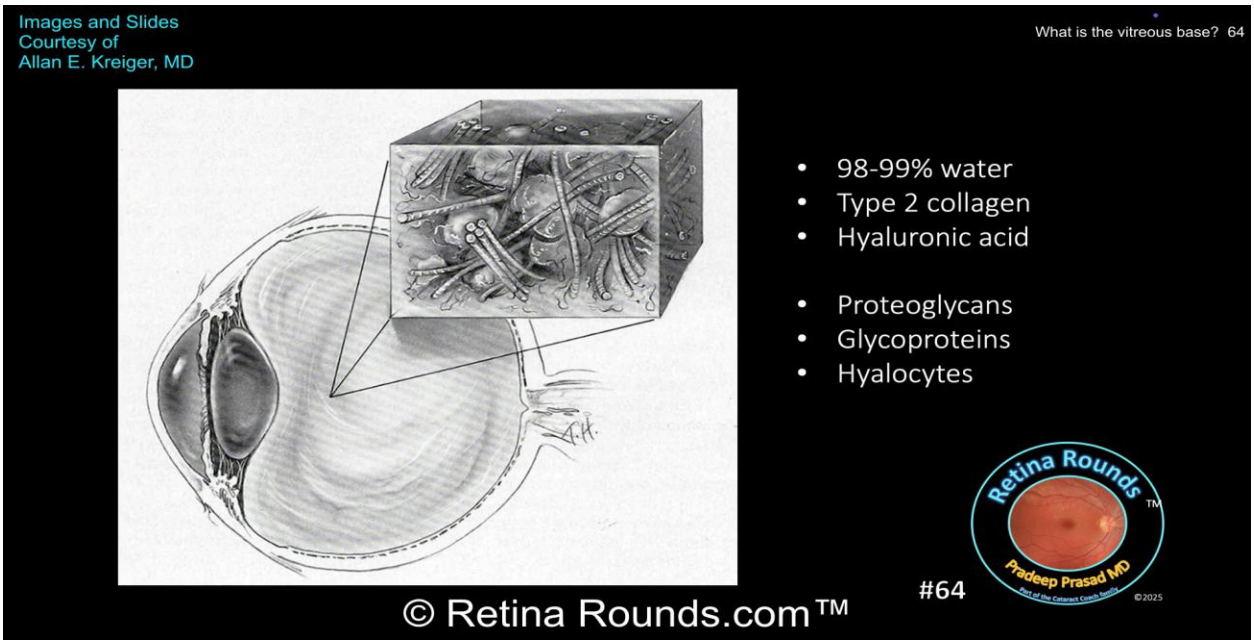
of the vitreous are integrated with the underlying retina and ciliary epithelium and cannot be detached from these underlying structures at the vitreous base during a vitrectomy, an induced PVD extends to the posterior margin of the vitreous base, while the vitreous can be removed posterior to the vitreous base, the vitreous overlying the vitreous base cannot be removed and must be trimmed or shaved with a vitreous cutter.

The evaluation of vitreous base pathology is best performed with indirect ophthalmoscopy with the assistance of scleral depression.

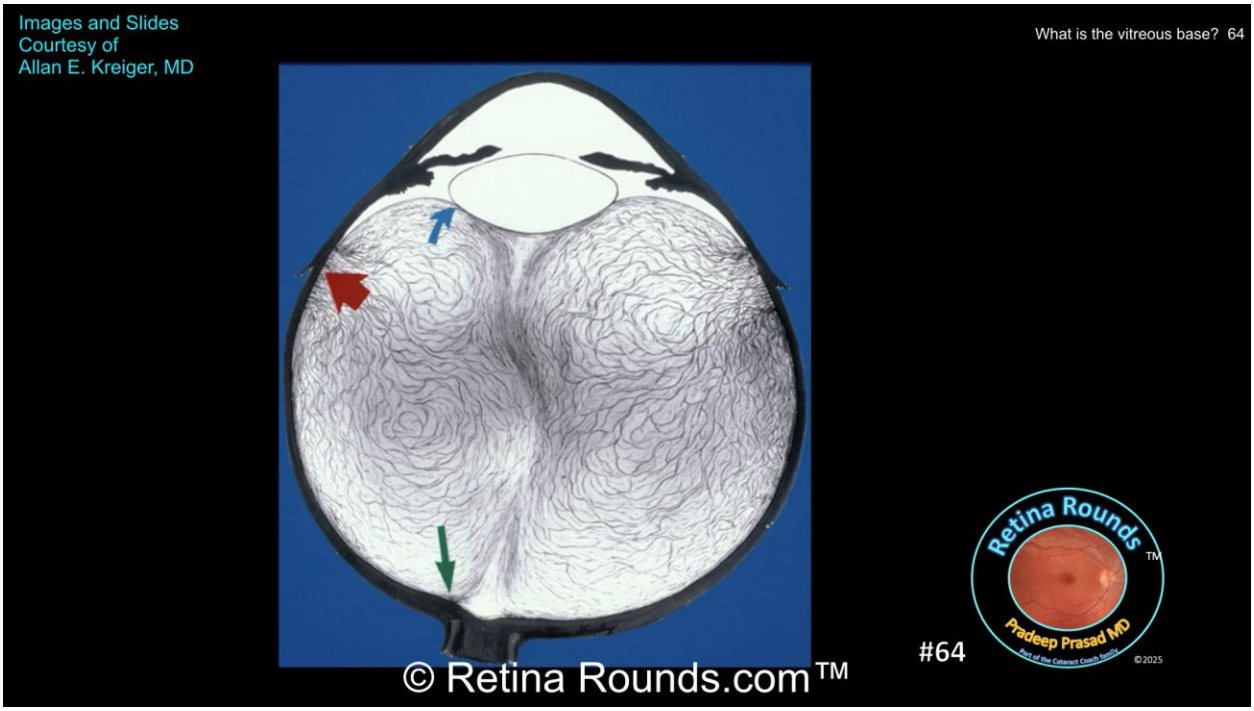
It's important to remember that the vitreous base is like a donut or a ring that straddles the ora serrata 360°, placement of an encircling buckle for example is intended to indent the eye at the location of the vitreous base, that's what's meant by using a scleral buckle to support the vitreous base, a buckle in this location can decrease traction at the base and therefore can decrease traction of the vitreous at the vitreous base on adjacent retinal breaks.



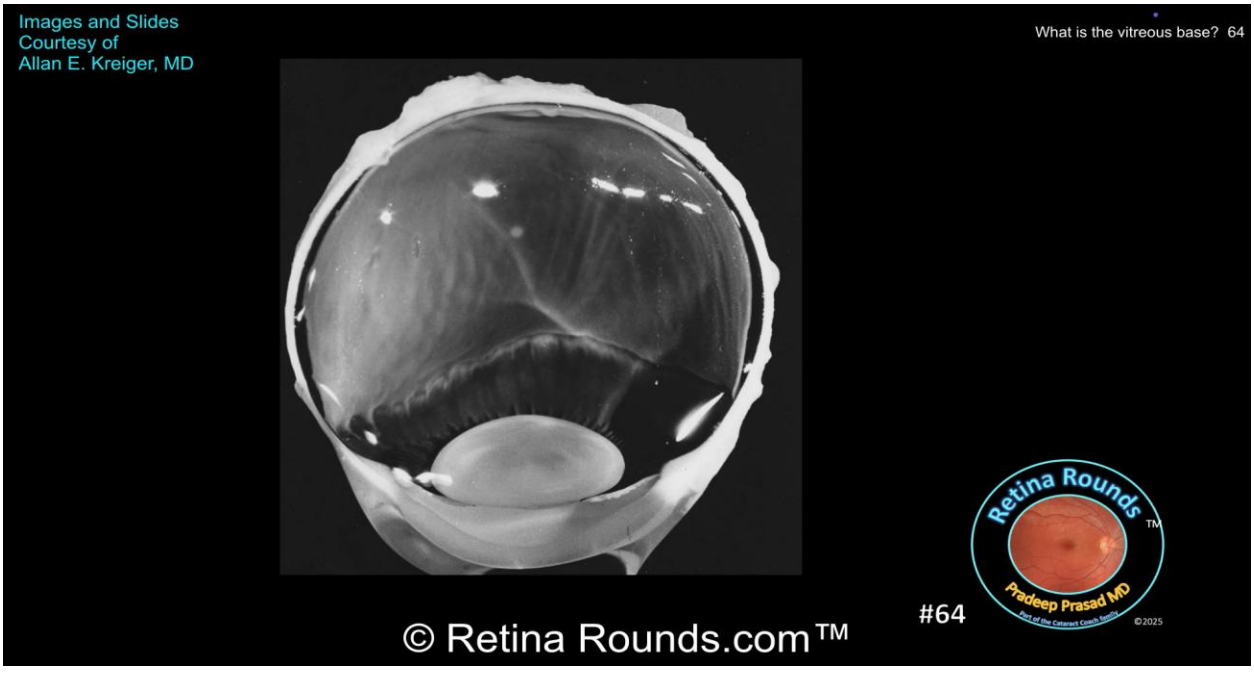
The width of the pars plana and the vitreous base is different in different quadrants. Temporally, the pars plana is wider and the extension of the vitreous base onto the anterior retina is narrower as shown on the temporal side of this diagram marked, the speckled area marked P indicates the posterior extension of the vitreous base. Nasally, the pars plana is narrower and the posterior extension of the vitreous base is wider that's seen at the left side of the diagram.



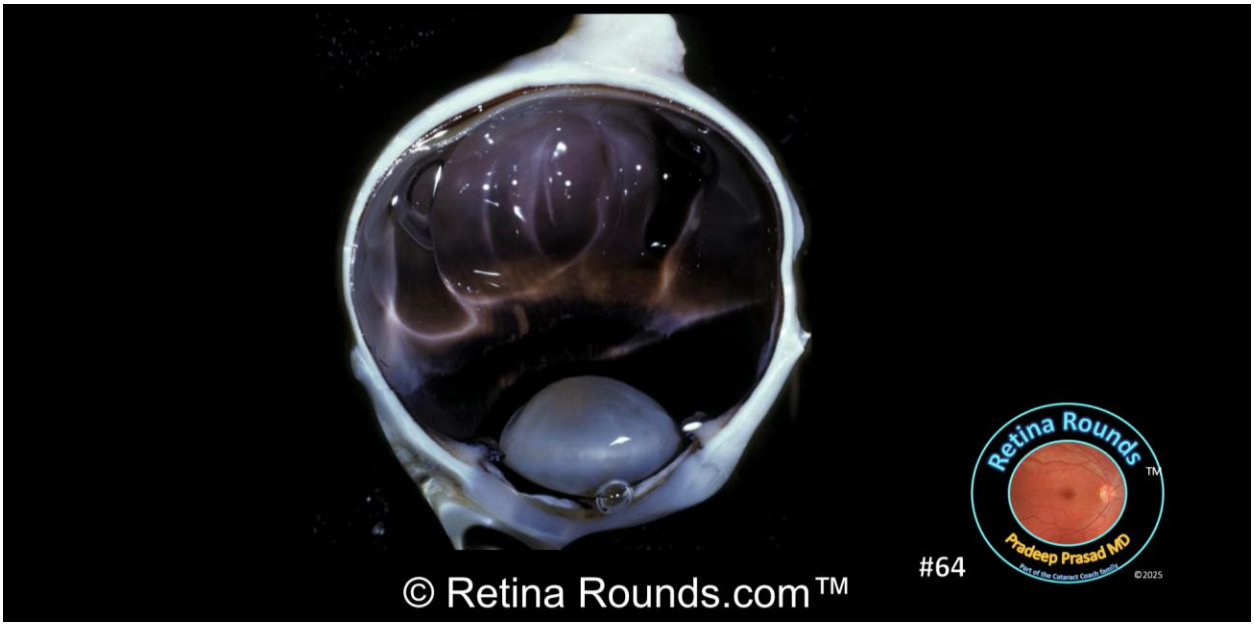
98 to 99% of the vitreous body is composed of water, type 2 collagen fibers give the vitreous body some structure and hyaluronic acid gives the vitreous body a gel-like consistency. The vitreous is also composed of proteoglycans, glycoproteins and hyalocytes.



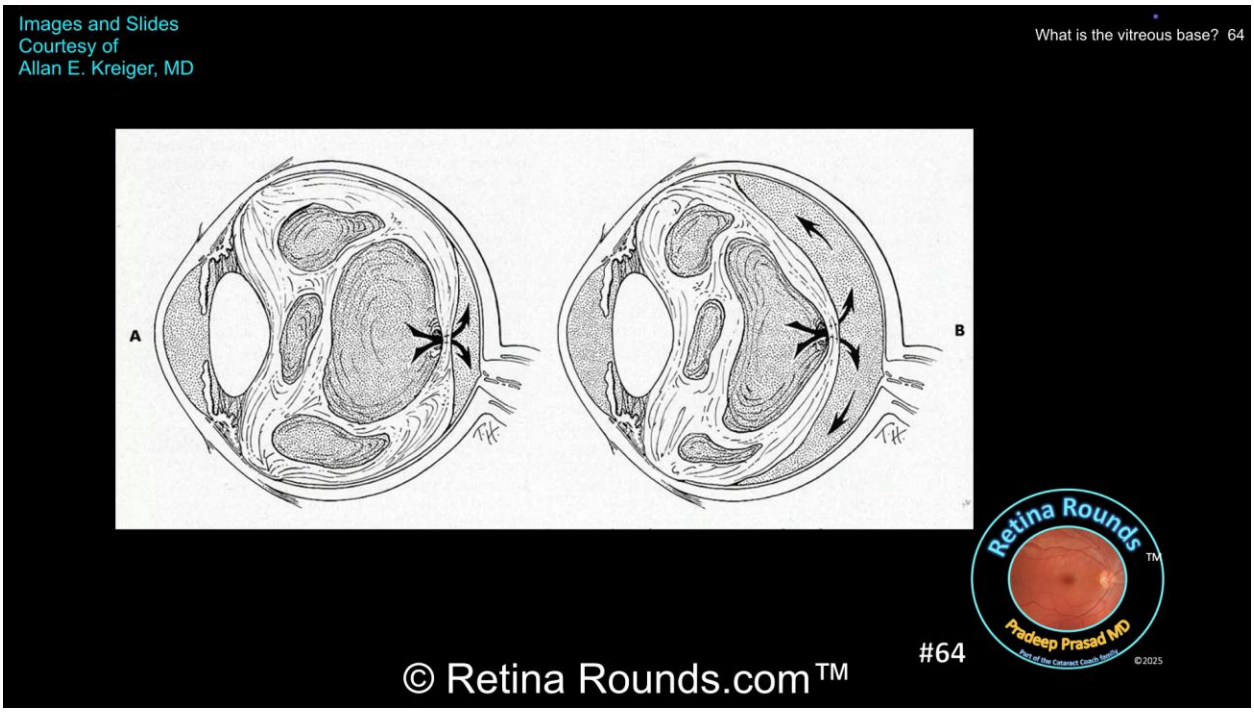
The vitreous has numerous adhesion points and again is integrated with the underlying retina and pars plana epithelium at the vitreous base shown by the red arrow. Tight adhesions are also present over the optic nerve shown by the green arrow, at the posterior lens capsule the so-called Wieger's ligament shown by the blue arrow and over the macula and retinal vessels.



This autopsy eye shows the vitreous of a child which is semi-solid and adherent to the retina. You can see with the eye hung upside down that the vitreous maintains its adhesions to the posterior retina.

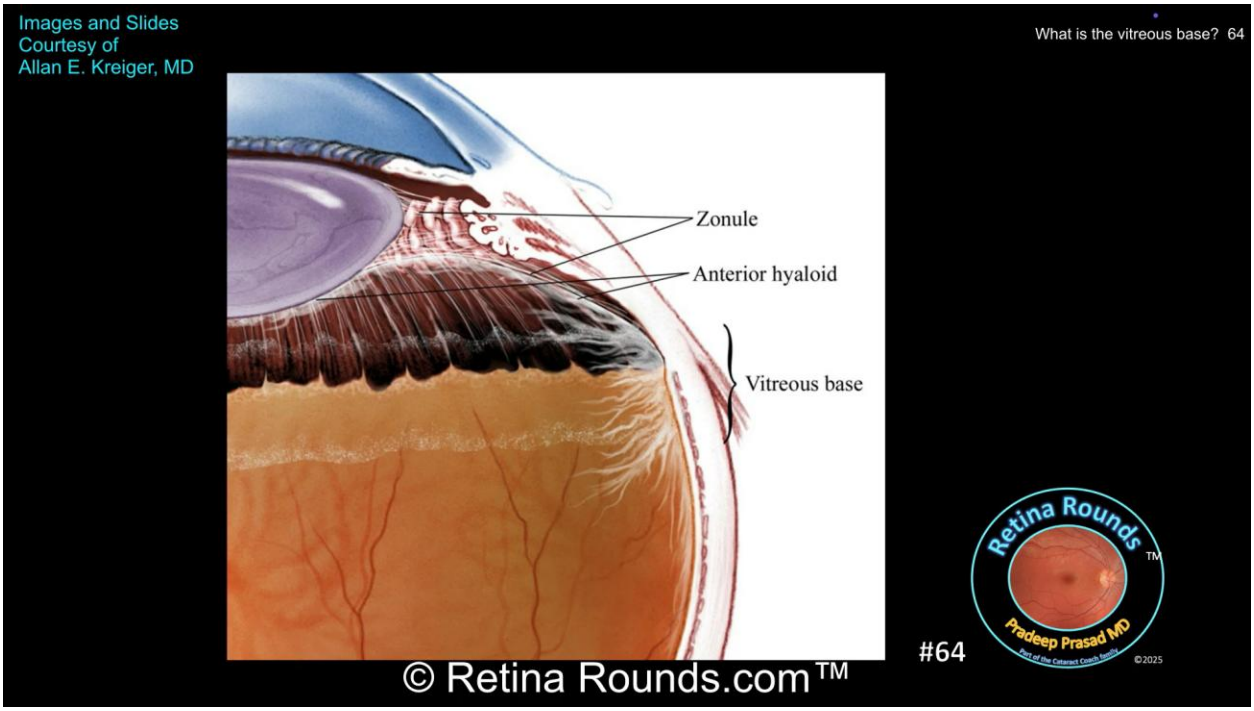


As we age the vitreous begins to form liquefied lacunae as shown in this autopsy eye, this is termed vitreous syneresis.



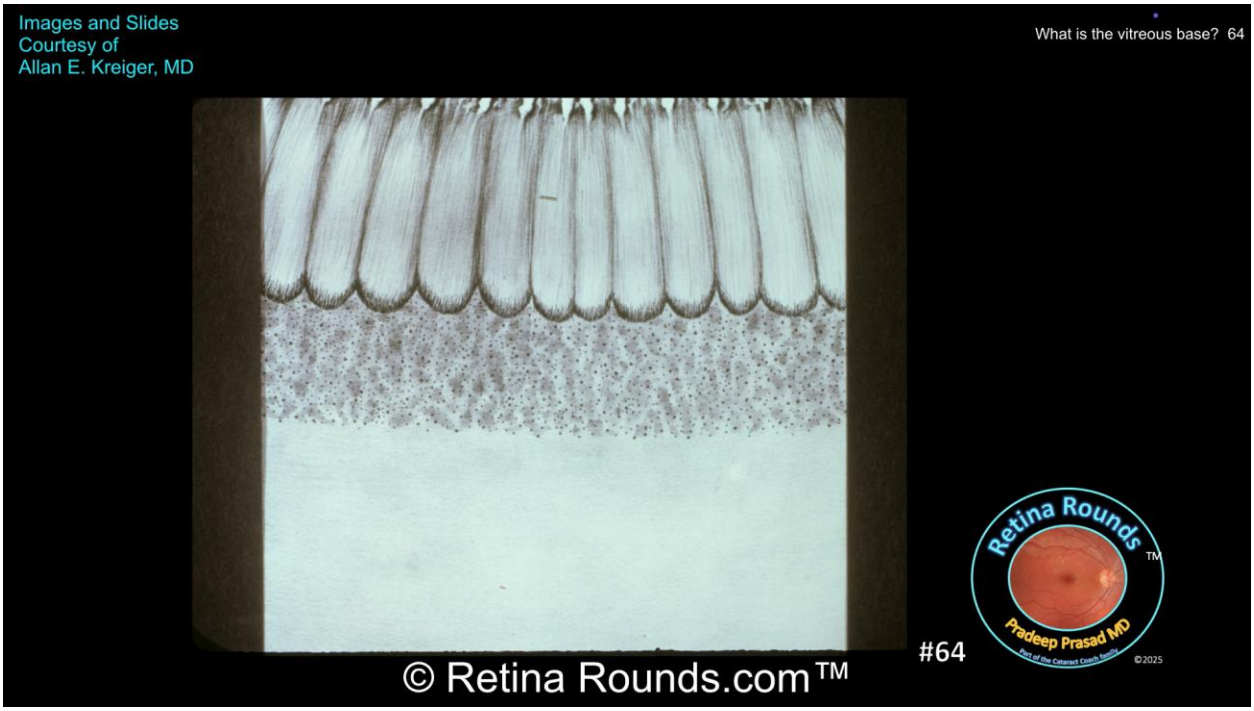
Eventually liquefied vitreous begins to dissect the posterior hyoid away from the retina resulting in a posterior vitreous detachment.

Here's an autopsy eye with a posterior vitreous detachment. You can see with the eye hung upside down that the vitreous has pulled away from the retina but maintains its integration with the anterior retina and pars plana at the vitreous base.

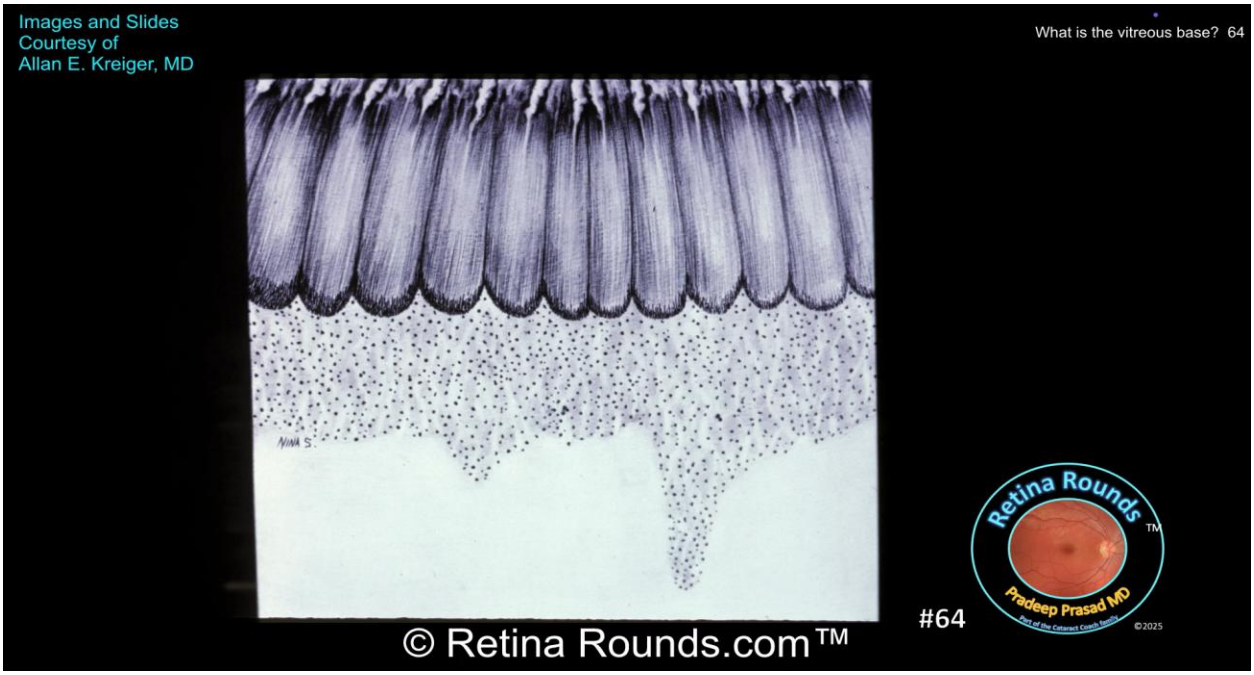


Here's a schematic of the vitreous base which again straddles the ora serrata, the vitreous extends posteriorly over the retinal surface and anteriorly over the ciliary body and lens. In cases of proliferative vitreoretinopathy, the vitreous base may contract resulting in anteroposterior and

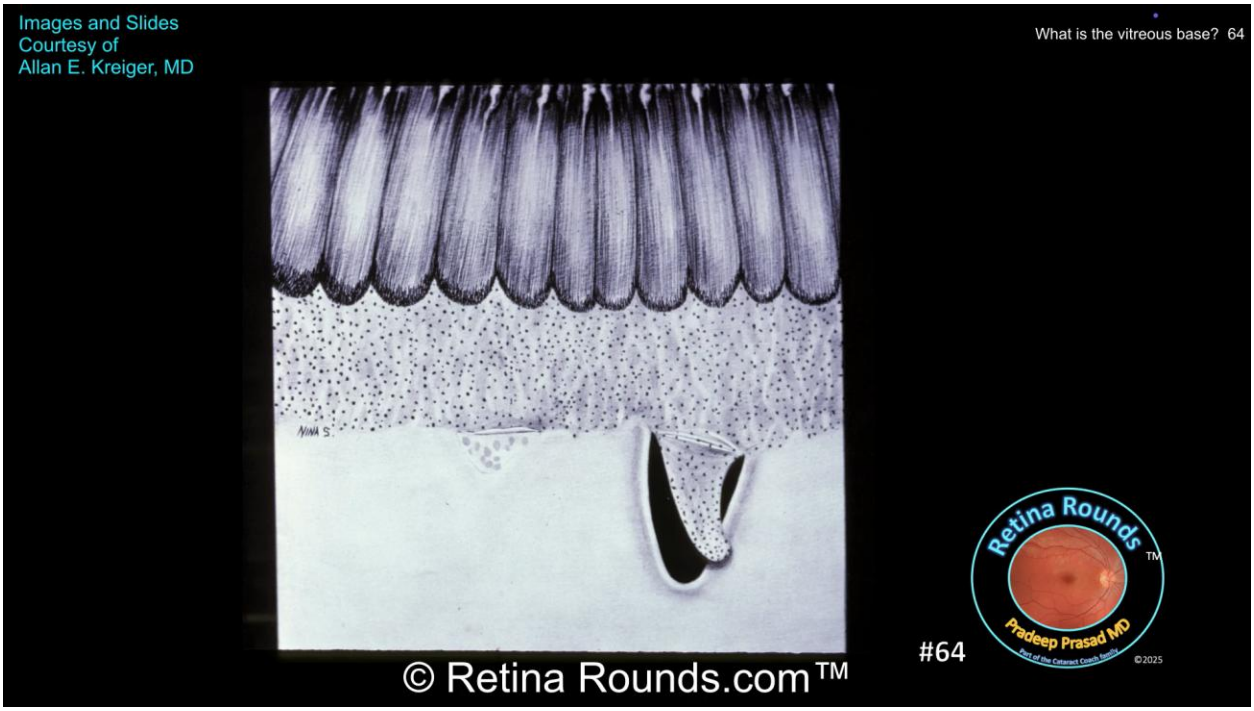
circumferential traction on the ciliary body which can result in hypotony, the lens capsule and the vitreous adherent to it can serve as a framework upon which anterior PVR may form and is the reason why the lens capsule may be removed in patients with PVR to decrease the risk of anterior base contraction resulting in hypotony.



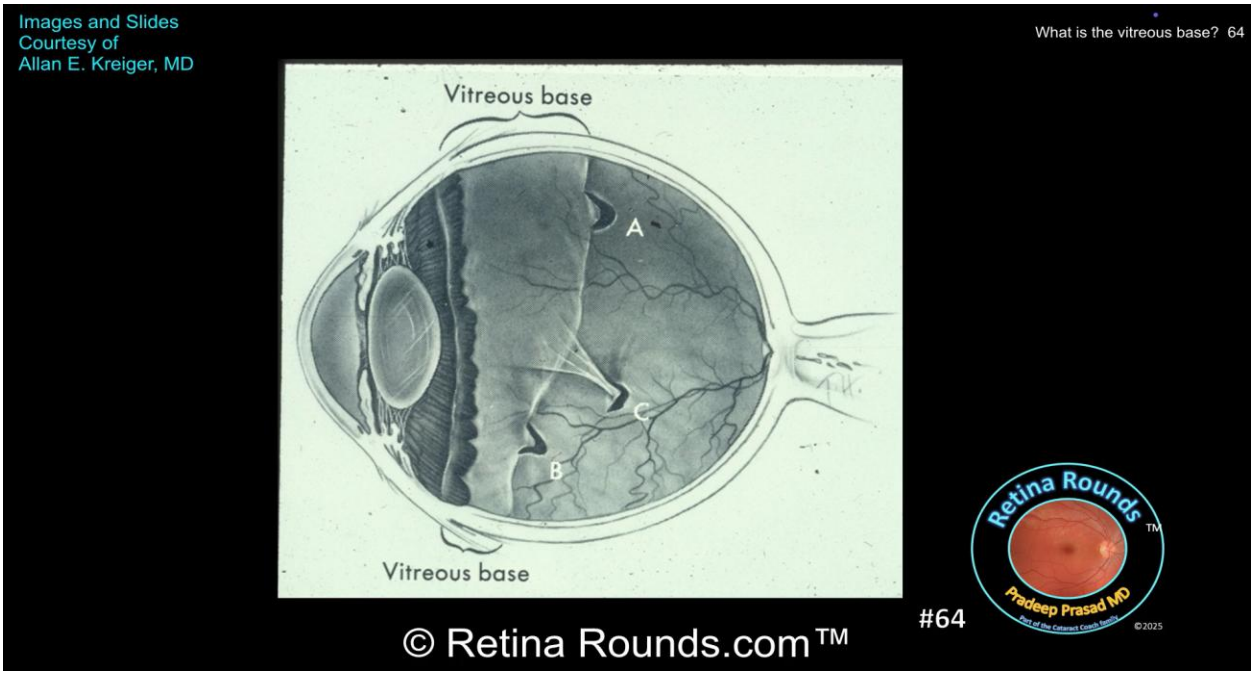
Typically, the posterior base has a regular shape that runs roughly parallel to the ora serrata, the posterior base is shown in this diagram as a speckled area that's posterior to the scalloped edge of the ora serrata.



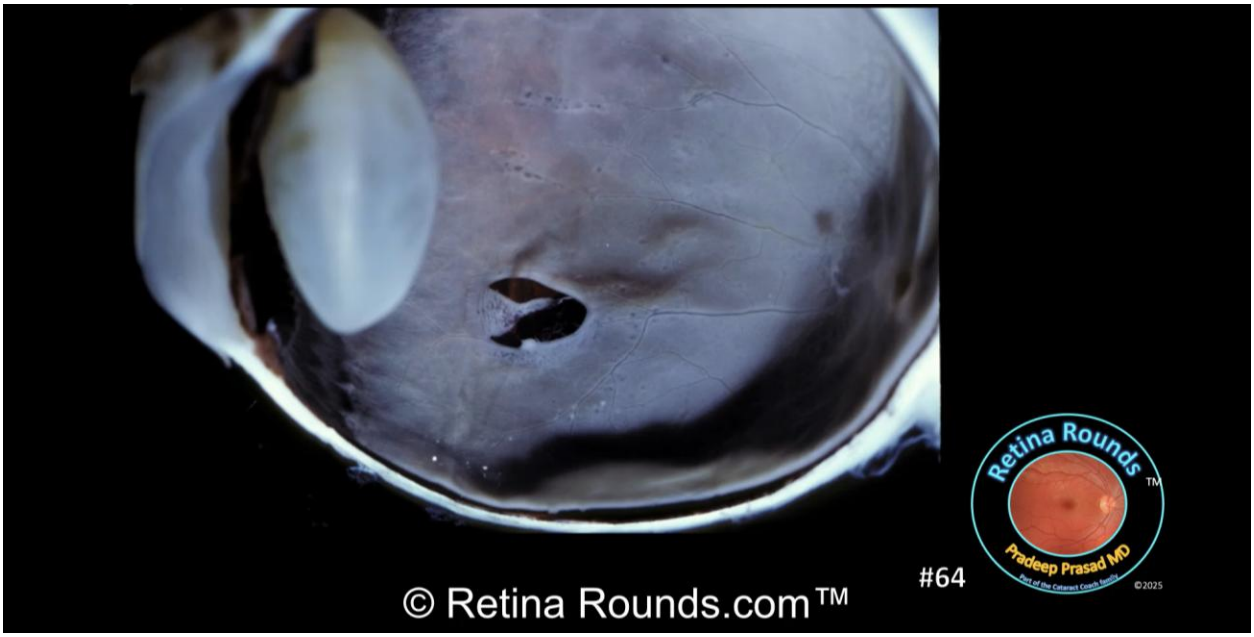
However, the base may also have an irregular border as is shown here. Incidentally white with and without pressure reflects the visualization of the vitreous base which is caused by a light reflection from the integrating pattern of collagen fibers to the underlying retina. When you see white with or without pressure you may have noticed that the posterior edge sometimes has a regular or an irregular posterior border and this demonstrates the variability in the posterior extension of the vitreous base.



Retinal breaks may form at irregular posterior extensions of the vitreous base as is shown here.



This schematic shows the location of juxtabasal retinal breaks marked A and B, a more posterior break letter C shows vitreous adhesions on the retinal break that extends to the vitreous base. When performing a scleral buckle or a vitrectomy for a retinal detachment, the surgical goal is to relieve the traction of the vitreous base and vitreous on the retinal break; with scleral buckling this is achieved by indenting the outer wall of the eye, and with vitrectomy it's achieved by lysing vitreous adhesions from the retinal break and shaving the base.



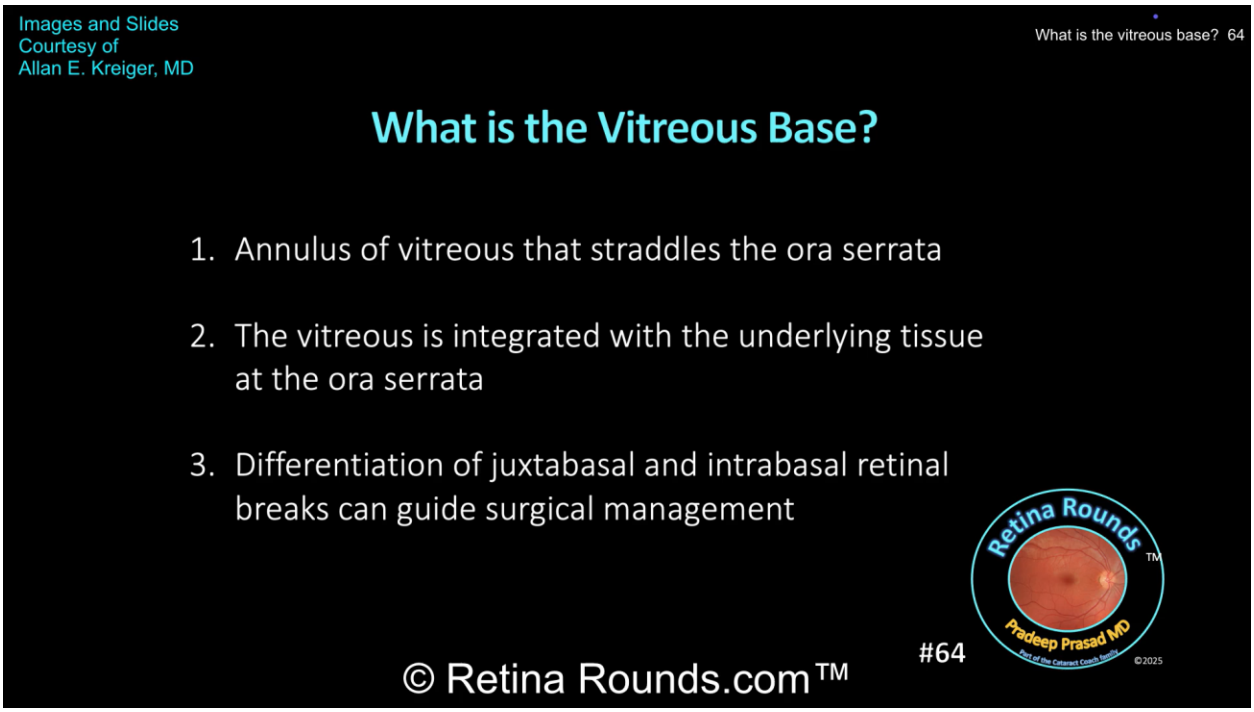
Here's an autopsy eye showing a juxtabasal retinal tear.

Another autopsy eye showing the same.

Here's an autopsy eye hung upside-down showing traction of the vitreous at the posterior edge of the vitreous base causing multiple retinal breaks.

It's important to distinguish juxtabasal breaks which are typically seen with a posterior vitreous detachment from an intrabasal break which is shown here. Retinal dialysis detachments are associated with intrabasal breaks and are not typically associated with a PVD. They're usually seen in younger patients and may be associated with ocular trauma.

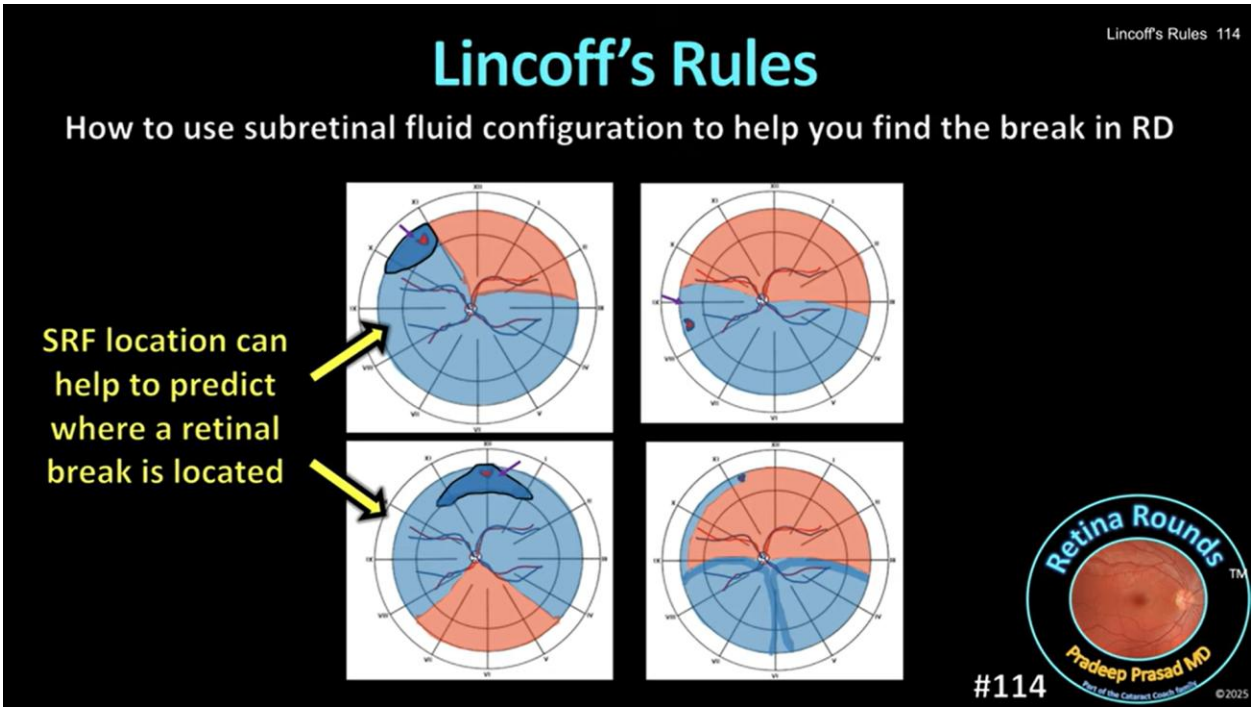
Here's another autopsy eye with an intrabasal retinal break at the ora serrata. Retinal dialysis detachments from intrabasal breaks have a very high success rate when treated with a scleral buckle. Vitrectomy in these eyes is generally not the ideal method of surgical management this is unlike a PVD associated retinal detachment where either a pneumatic retinopexy, scleral buckle, vitrectomy, or combination buckle and vitrectomy may be chosen based on the patient's clinical features and surgeon preference.



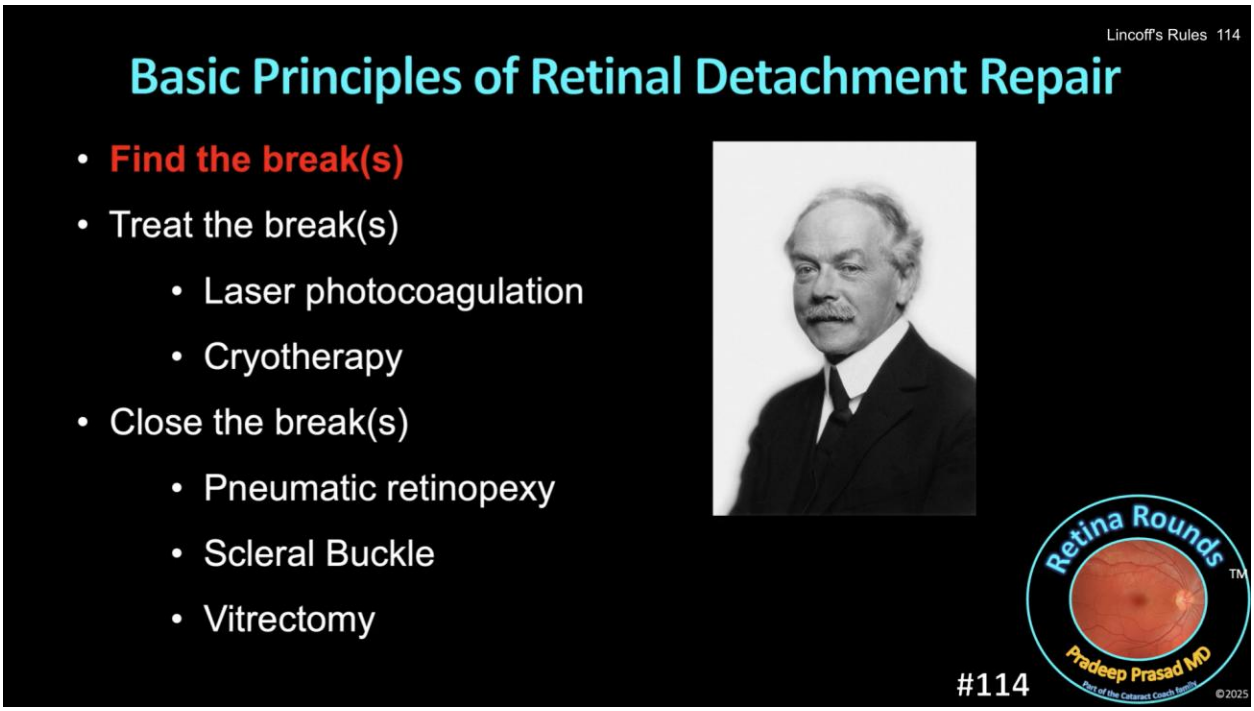
In summary, the vitreous base is an annulus of vitreous that straddles the ora serrata and extends approximately 2 mm posteriorly over the anterior retina and 2 mm anteriorly over the pars plana epithelium. The key point is that the vitreous is integrated with the underlying tissue at the vitreous base, the vitreous here cannot be surgically removed and traction at this location can only be relieved through scleral buckling or by using a vitrector to shave the vitreous at the vitreous base. Lastly, understanding the relationship between a retinal break and the vitreous base can guide surgical management: Retinal dialysis detachments associated with intrabasal breaks which are typically proximal to the ora serrata are best treated with scleral buckling whereas a variety of treatment options can be considered for juxtabasal retinal detachments which are typically associated with the PVD.

- **Lincoff's Rules**

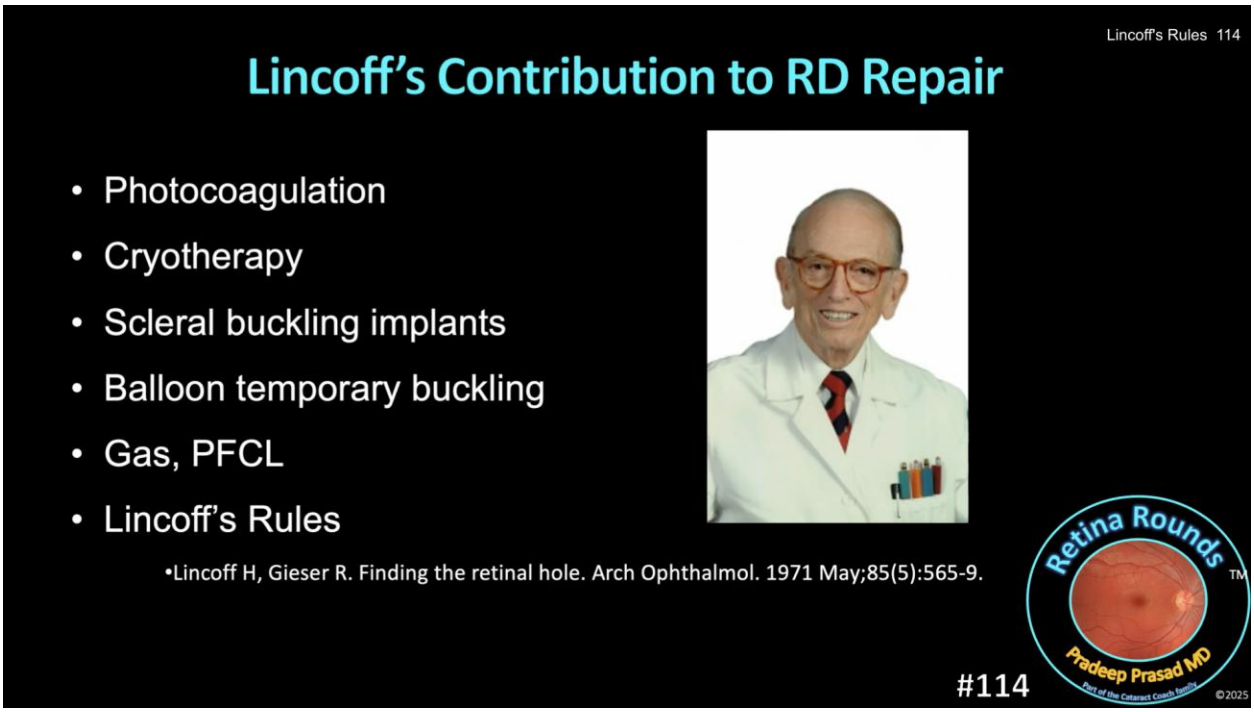
Link: https://www.youtube.com/watch?v=CCBSVEoCjkY



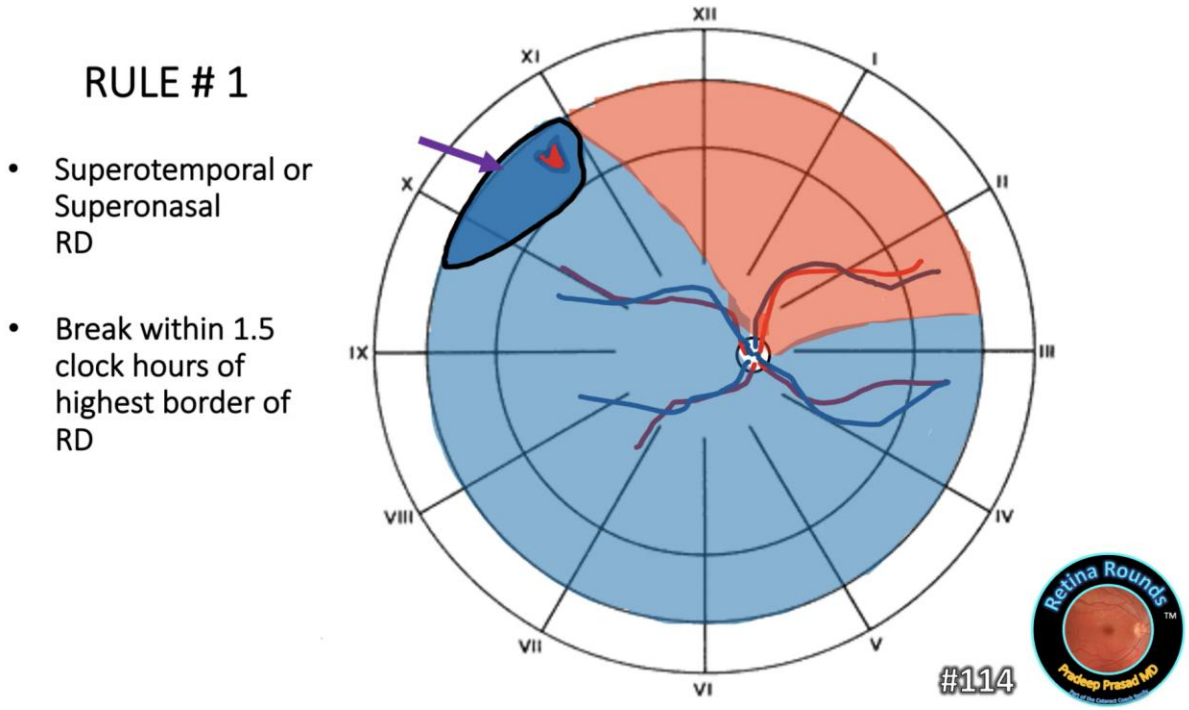
Before you can repair a retinal detachment, first you have to find the retinal breaks. However, finding the causative retinal break can be challenging. In today's episode we'll review Lincoff's rules which can help guide you to find retinal breaks based on the configuration of subretinal fluid.



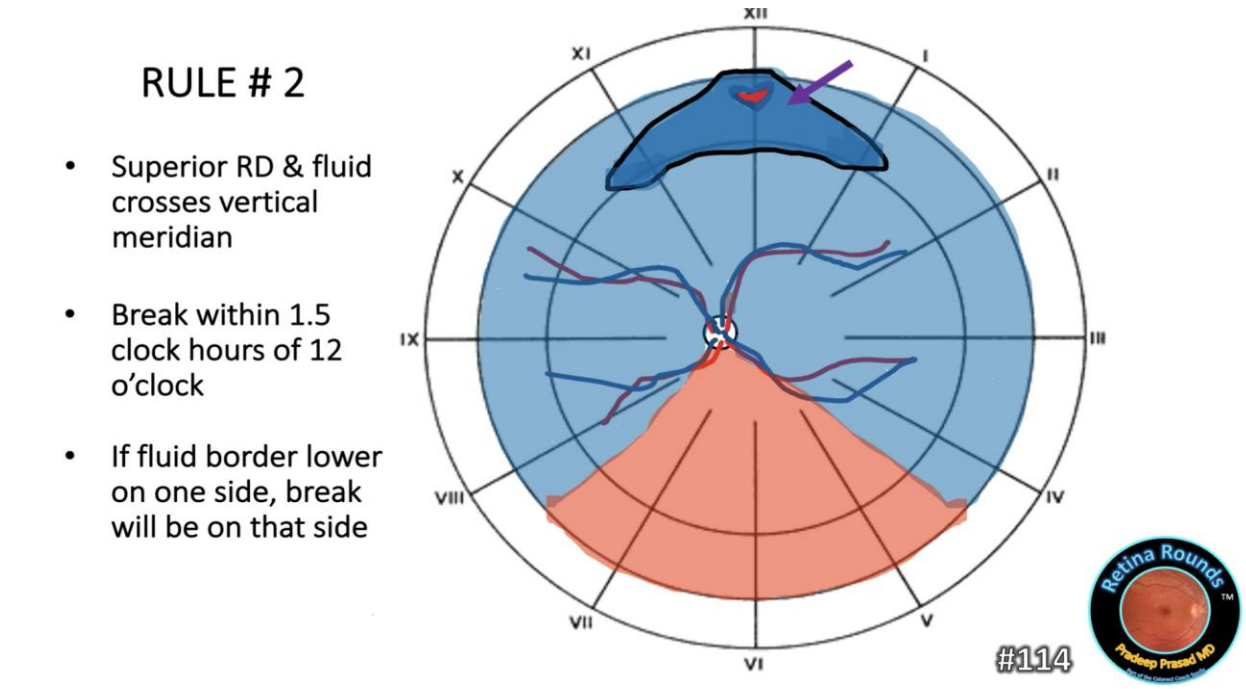
Now more than a century ago Dr Jules Gonin gave us our playbook for how to fix retinal detachments and there are three basic principles: First find the break, next close the break by creating some form of chorioretinal adhesion and while other techniques have been historically employed we currently use either laser photocoagulation or cryotherapy and last close the break meaning re-oppose the retina to the underlying RPE and our options include pneumatic retinopexy, scleral buckling and/or vitrectomy.



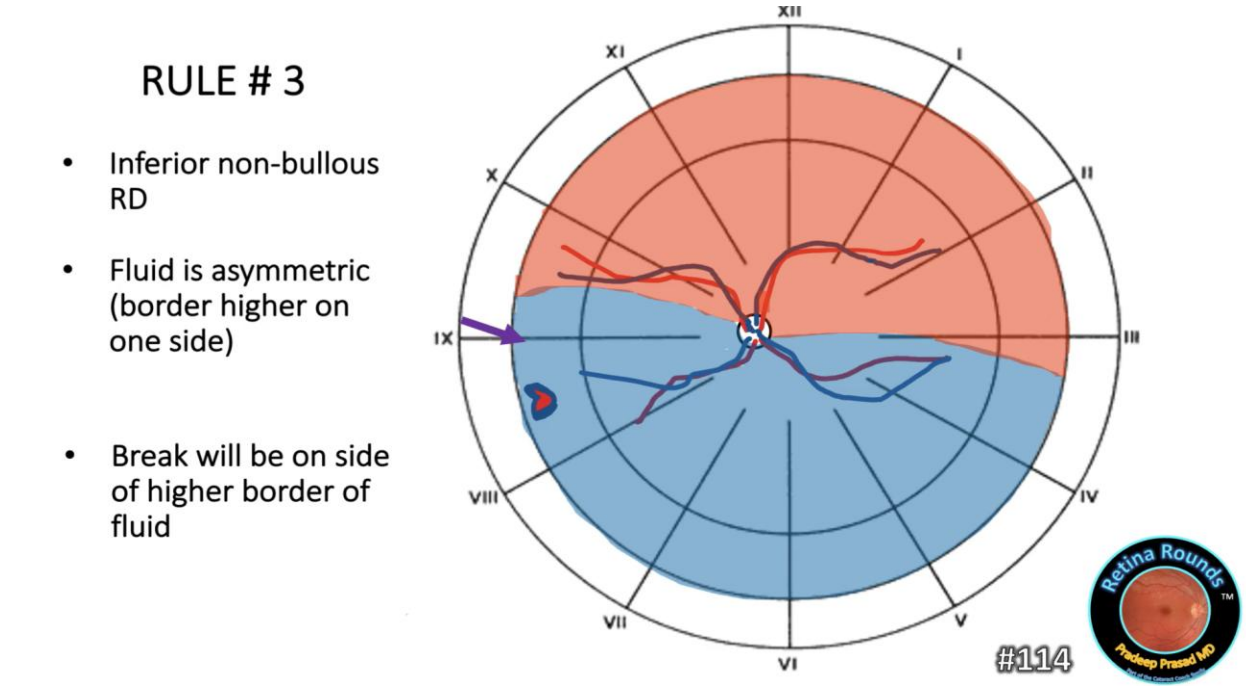
Let's take a moment to recognize the numerous contributions Dr lincoff made to the treatment of retinal detachments, these include helping to develop photocoagulation, cryotherapy, scleral buckling implants, the lincoff's balloon which is a temporary buckling method and the inspiration behind modern attempts at temporary buckling using viscoelastic agents, helping to introduce gas and PFCL for retinal detachment repair, and of course the so-called lincoff's rules which are based on his publication with Dr Kreissig in 1971. So, let's dive into lincoff's rules and we'll discuss some other tips for identifying retinal breaks at the end of the episode.



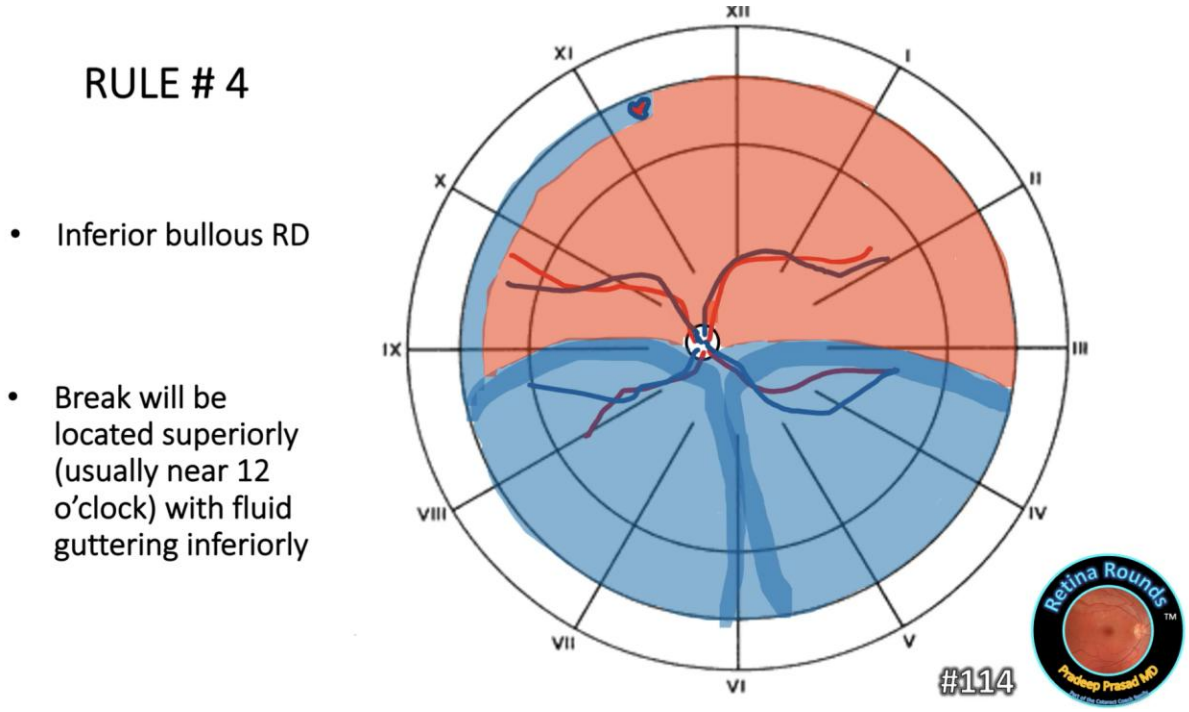
Rule #1 for superotemporal or superonasal retinal detachments, the brake almost always within 1 and 1/2 clock hours of the highest border of the retinal detachment. So, you can see in this diagram a superotemporal retinal detachment in the right eye the high-water mark of the detachment is roughly at the 11:00 clock hour position, and you can see that the detachment extends inferiorly and is involving the nasal retina as well but the fluid level is asymmetric only rising to about the 2:30 clock hour level nasally. So, in this eye with the fluid border being higher temporally, the break is most likely going to be between the 9:30 to 11:00 clock hour positions.



Rule #2 now this time we have a superior retinal detachment and you can see that the fluid crosses the vertical meridian meaning we have a superior retinal detachment involving both the nasal and temporal halves of the retina and in this case one can expect the break to be located superiorly at roughly the 12:00 clock hour position extending 1 and a half clock hours in either direction. One note here is that if you see that the fluid border is lower on one side than another, then the break will likely be on that side. So, in this case the patient's left eye let's say that the fluid border was lower on the nasal side than on the temporal side in that case we would expect the break to be superior but more likely somewhere between 10:30 and 12:00.

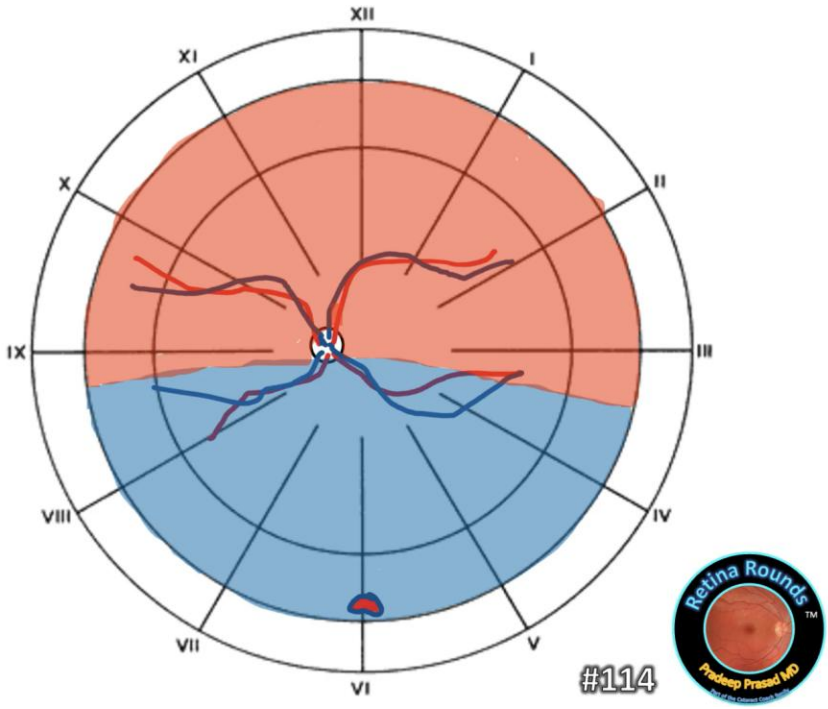


Rule #3 here we have an inferior non-bullous retinal detachment, you can see on the diagram the fluid border is asymmetric, now based on this rule we would expect the break to be on the side where the fluid border is higher. So, in this patient's left eye with the fluid border being higher nasally than temporally, we would expect the break to be located in the inferonasal quadrant.

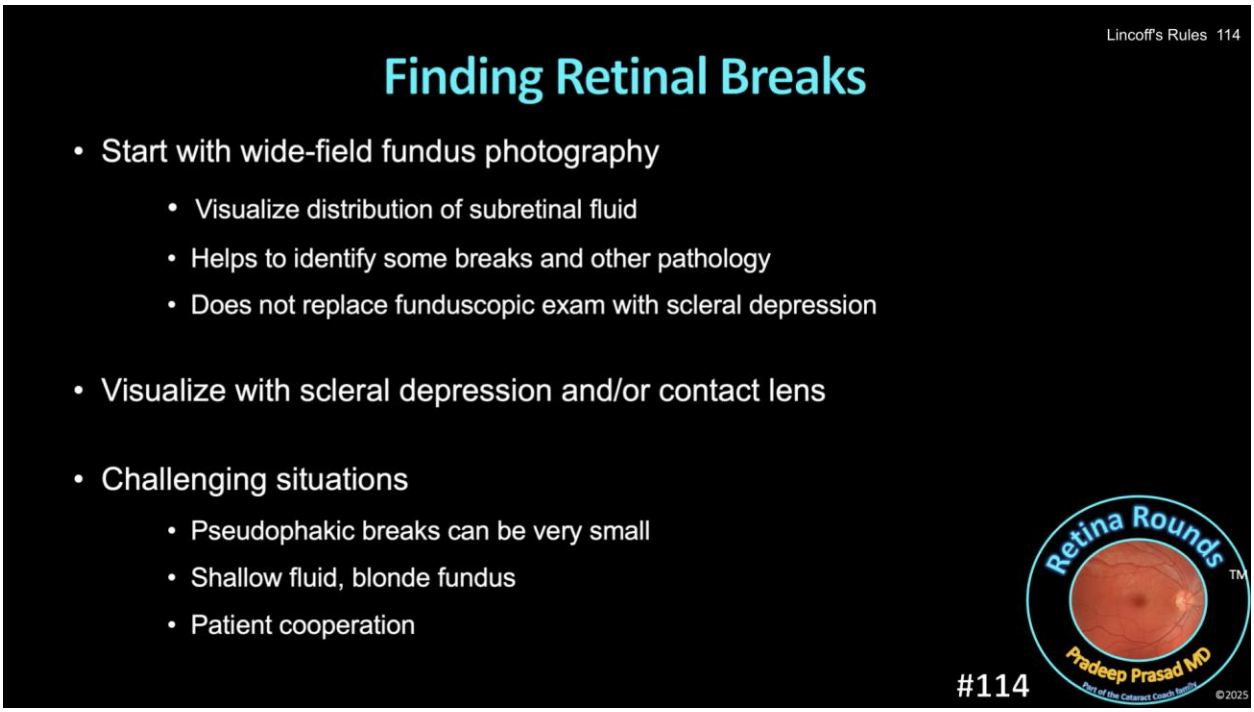


Rule #4 how about a bullous inferior detachment, this situation is a little bit different. For bullous inferior retinal detachments, we actually would expect the break to be superiorly located, and you can remember this based on the effect of gravity, the bullous attachment occurs inferiorly because the superior break is allowing fluid into the subretinal space and that fluid is pooling inferiorly, if there were an inferior break the fluid wouldn't be located and the detachment would likely be shallow. This is rule number four, again if you have an inferior bullous detached retina, most likely you have a superior break, and this is often going to be around the 12:00 clock hour position with fluid guttering down into the inferior subretinal space.

- Inferior non-bullous RD
- Symmetric fluid border
- Break will be located at 6 o'clock

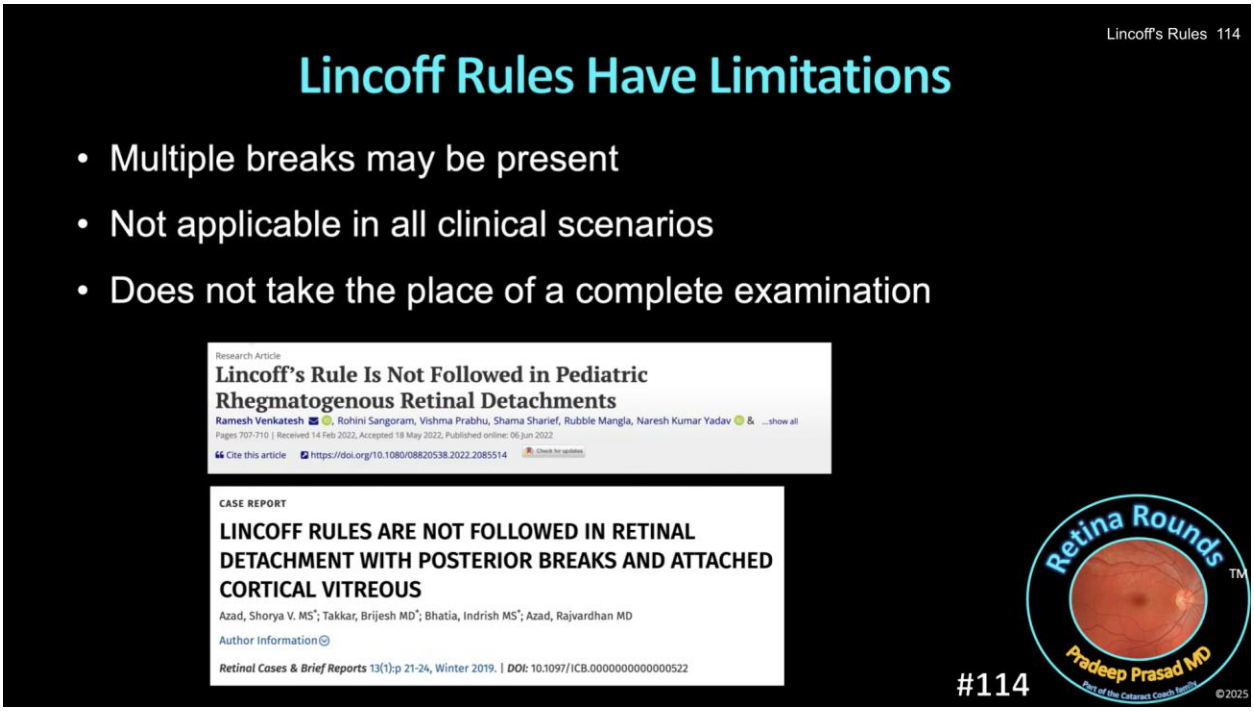


There are modifications to Lincoff's rules and this is one of them. Again, we have an inferior non-bullous retinal detachment, and here unlike the case in rule number three, we have a fluid border that's roughly symmetric, in these cases you can expect the break to be located at the 6:00 clock hour position.



Here are a few additional tips when trying to find a retinal break. I generally like to start by reviewing a wide-field fundus photo, this allows me to visualize the distribution of subretinal fluid,

and based on Lincoff's rules I can be particularly vigilant for a break in the area where the break is most likely to be located. Wide-field photography can also allow you to visualize the break in some cases as well as other pathology like lattice degeneration. However, it goes without saying that fundus photography does not replace a complete fundoscopic examination with scleral depression. The superior and inferior quadrants, in particular, are not well visualized with wide-angle fundus photography and it almost never gives good visualization of the vitreous base and the peripheral retina proximal to the ora serrata. Peripheral visualization can be achieved not only with scleral depression exam, but also with the use of a contact lens like a Goldmann 3 mirror lens. Remember that some clinical situations can be particularly challenging to find retinal breaks: pseudophakic patients can have very small breaks near the ora and sometimes cortical remnants or lens edge artifacts can make visualization difficult. Finding the break can also be challenging in patients with shallow fluid and a blonde fundus. Now using Lincoff's rules can help guide you to the areas that need extra attention to find the positive break, and finally some patients may be highly photophobic or sensitive to scleral depression. In these scenarios, it's important to remain patient make use of topical anesthetics, have the patient keep both eyes open while fixating on a target with the fellow eye, and coach the patient on breathing as a method of distraction. It's never ideal to operate on a patient without a good understanding of the underlying anatomy and the extra time performing a careful examination is time well spent. If a break can't be visualized, keep in mind, the possibility of a serous or exudative retinal detachment that may need additional workup.

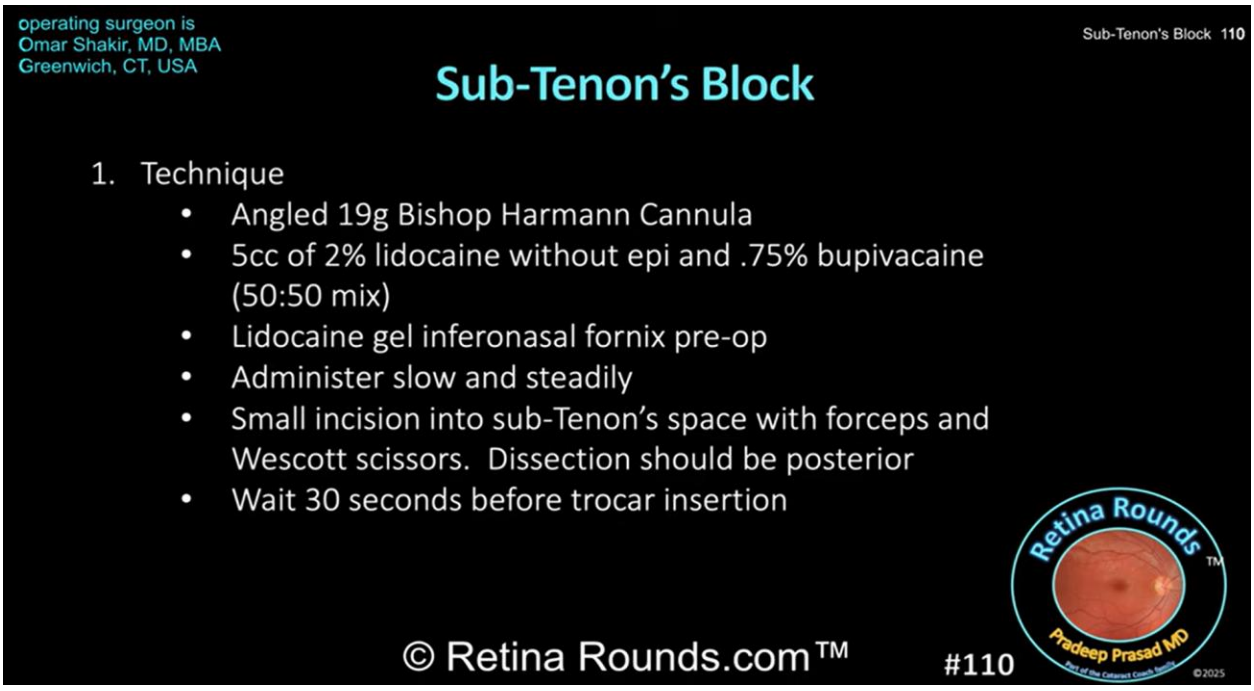


Now there are limitations to Lincoff's rules, sometimes multiple breaks may be present, and these rules may not be applicable in all clinical scenarios like patients who have already undergone surgery, those who have other ophthalmic diseases like diabetic retinopathy, pediatric patients, or those with posterior retinal breaks. While Lincoff's rules don't replace a complete examination, it can be a useful guide to focus your examination efforts.

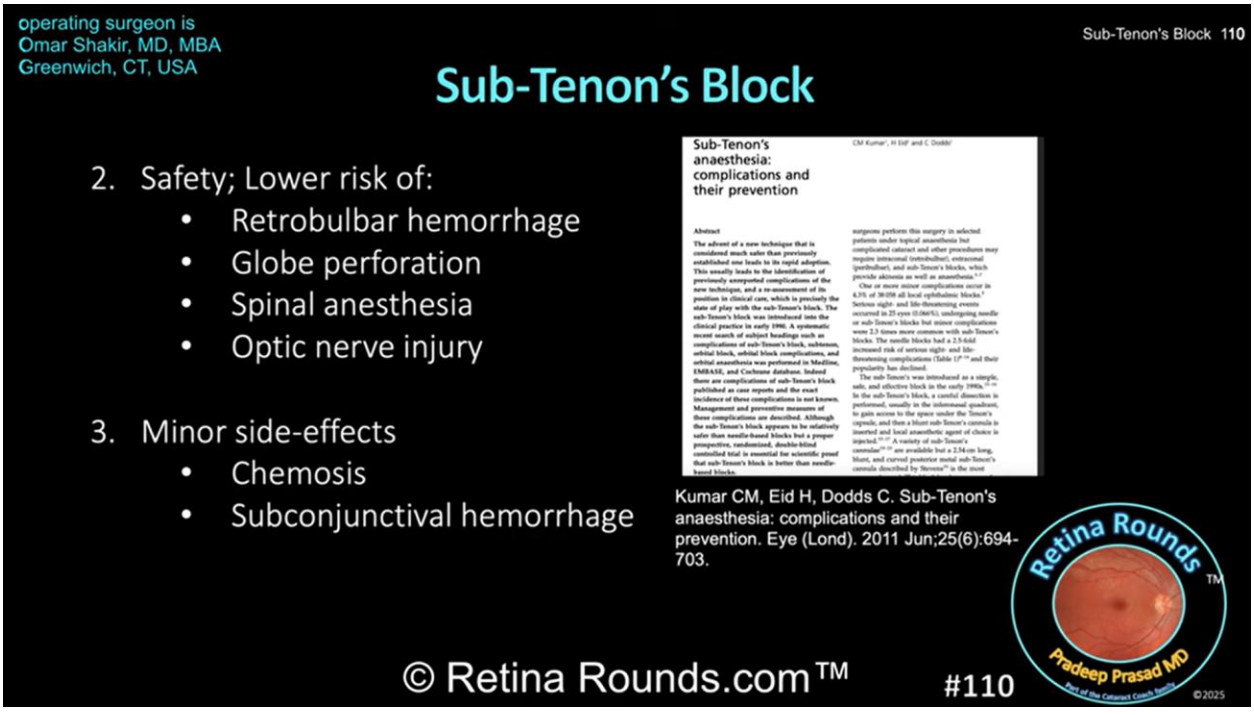
- **Sub-Tenon's Block**

Link: https://www.youtube.com/watch?v=CXs3iF5qQQA

Subtenon's blocks for ophthalmic surgery achieve two main purposes: anesthesia and akinesia, and there are two methods of administering blocks: One is with a needle block which is a retrobulbar block and the other is a subtenon's block. Both ultimately deliver anesthetic to the retrobulbar space but subtenon's blocks while potentially slower to achieve their maximum effect are much safer significantly decreasing the risk of retrobulbar hemorrhage, globe perforation, and inadvertent injection of anesthetic into the subarachnoid space which can result in potentially life-threatening spinal anesthesia. Now some surgeons only perform subtenon's blocks in higher risk situations like patients who are anti-coagulated, or those with long axial lengths. Other surgeons routinely perform subtenon's blocks on all of their cases.



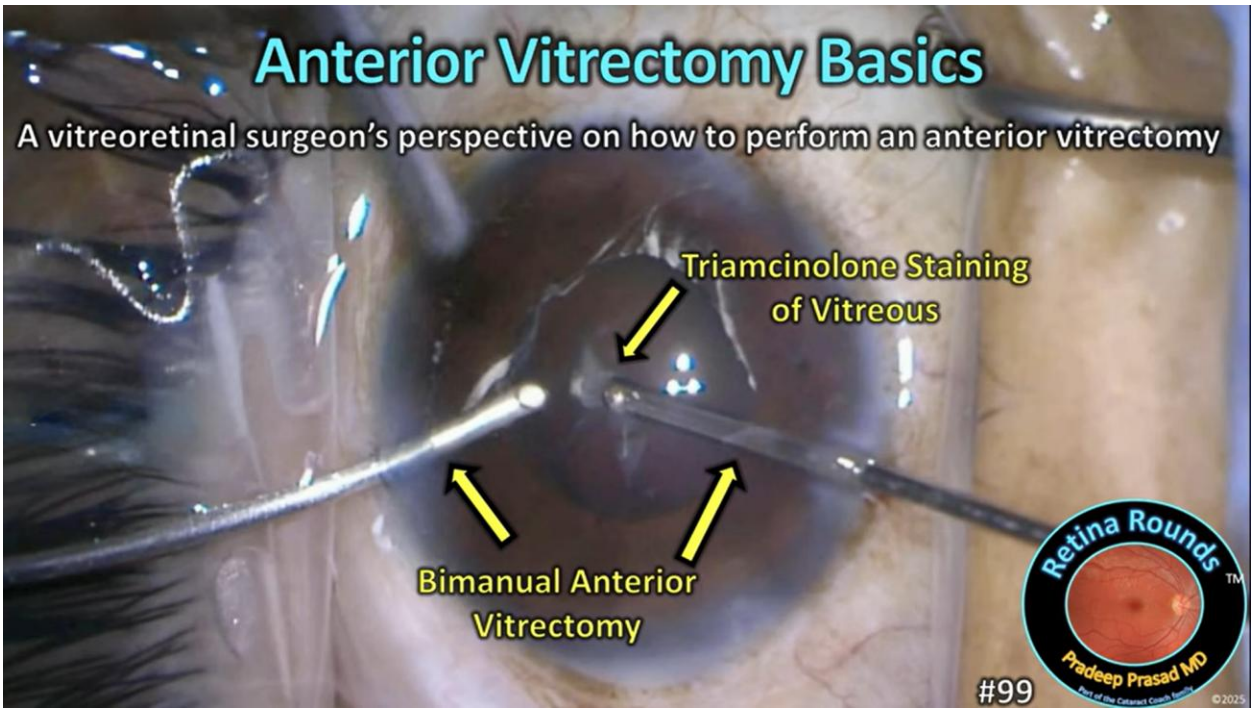
Here's a summary of some of the tips to successfully perform subtenons blocks. First, you want to use a blunt canula, I favor the use of an angled 19 gauge Bishop Harmann canula which is the same type of canula that can be used to drip BSS on the cornea, the block solution should typically contain a 50/50 mixture of 2% lidocaine without epinephrine which has a more rapid but shorter effect and 75% bupivacaine which has a slower effect but can have a longer duration. Remember that if the anesthetic effect wears off, supplemental anesthetic can be administered in the preop area. You can place some lidocaine gel in the inferonasal fornix to make the subtenons's incision less painful and this gel is rinsed away before the eye is prepped for surgery with betadine. When creating the incision, it's ideal to start in the inferonasal fornix so that any secondary chemosis is away from the areas where trocars will be placed, the incision should be small with the dissection oriented more posteriorly; too wide of an incision can allow the block solution to reflux while dissecting posteriorly. Be careful not to advance the scissors too far posterior to avoid any inadvertent globe or optic nerve injury. When injecting, be sure to inject slowly and steadily, any resistance that's encountered during the administration of the subtenon's block may be due to tenons capsule or orbital tissue blocking the tip of the canula and if this happens you can try to re redirect or reintroduce the canula until the injection can be done without significant resistance. Typically about a 5 to 6 cc block solution is adequate uh you might want to consider palpating the globe to make sure that the ocular tension doesn't get too high during administration of the anesthetic block volume. Sometimes more supplementation later is needed in those who have shallower orbits. Last after the block solution is administered, you want to wait about 15 to 30 seconds before placing the trocars. While I'm waiting, I like to apply a tetracaine soaked pledge over the trcoar sites just to make the trocars placement a little less uncomfortable for the patient.



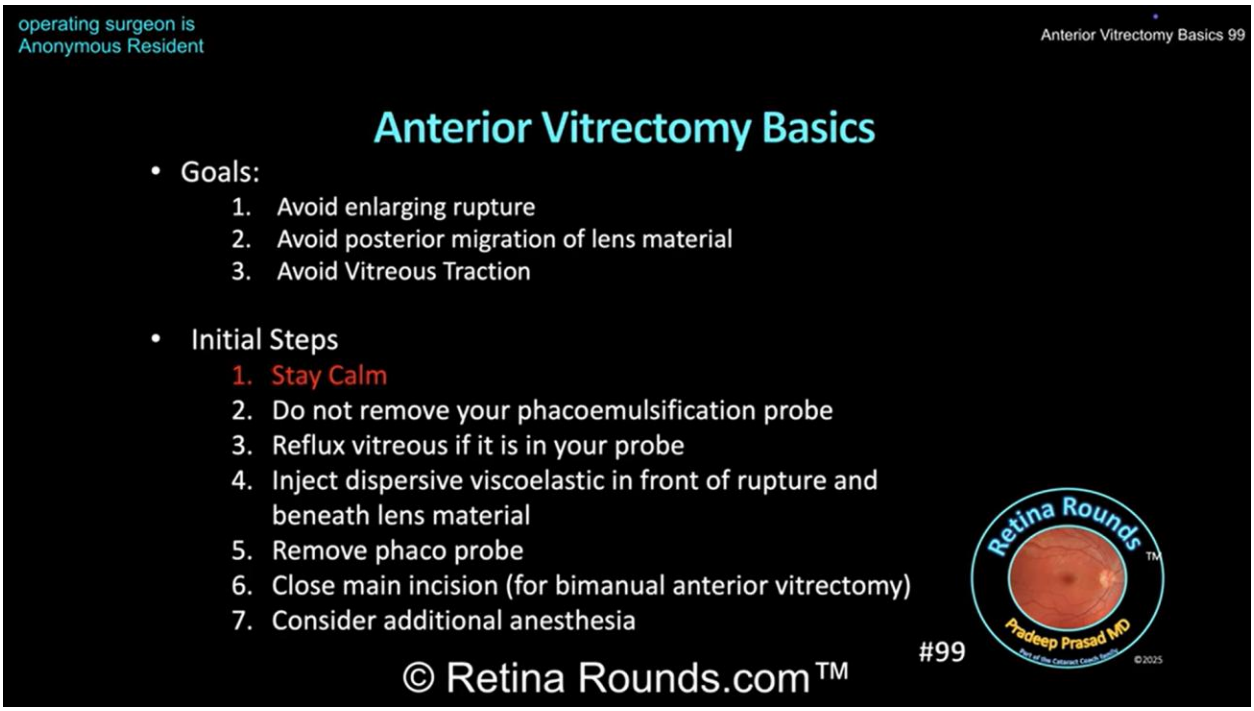
How about risk? well the complications associated with subtenon's blocks are much lower than those for needle blocks but subtenon's blocks are not without any risk. In this review by Kumar and colleagues retrobulbar hemorrhage, globe perforation, spinal anesthesia, and optic nerve injury have all been reported in association with subtenon's blocks albeit at a much lower rate. Some surgeons don't like subtenon's blocks since they can be associated with conjcunctival chemosis or hemorrhage. In my experience this can be mitigated by good technique, and if chemosis is an issue, a small incision in tenon capsule can be performed and the excess fluid can be milked away with a cotton tipped applicator in the same way that chemosis can be managed during cataract surgery if the cornea wound is too close to the conjunctiva. Time to anesthesia and akenisa can also be a concern but with a little bit of patience, I found that this method of blocking patients can be just as effective as needle blocks.

- **Anterior Vitrectomy Basics**

Link: https://www.youtube.com/watch?v=1ori3OpAg5E



I'm going to give you a vitreoretinal specialist perspective on how to perform anterior vitrectomy. There are a lot of great videos on this topic on CataractCoach and I would highly recommend that you check them out. Today, we'll talk about some basic concepts of anterior vitrectomy and for our next episode we'll go into more details on machine settings and fluidics so with that said let's dive right in.

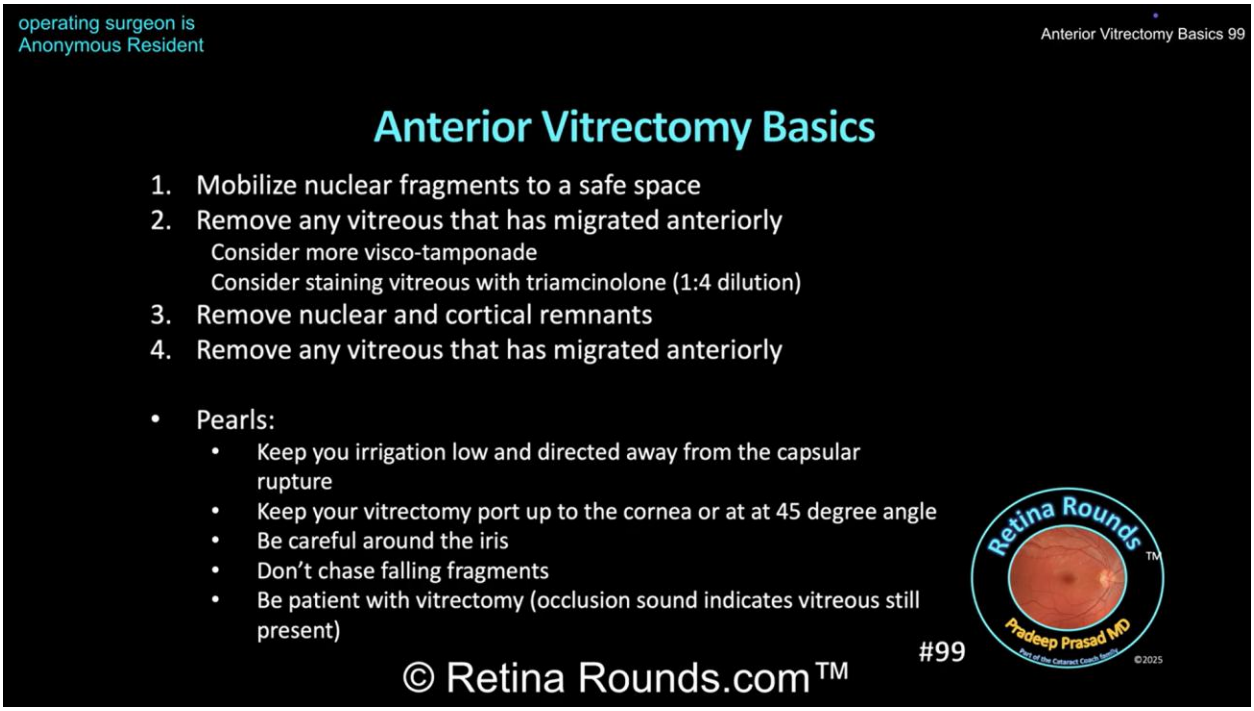


Let's just pause for a moment and talk about what you do when you've got a posterior capsular violation. Now the anterior hyoid face may be intact and vitreous may not be coming forward. What you want to do when you see that posterior capsular violation is to avoid enlarging that rupture. You want to avoid enlarging it which may create a higher likelihood for nuclear or cortical fragments to migrate into the posterior segment and if vitreous is coming forward you want to avoid vitreous traction. So, when you see this, the first the most important piece of advice I can give you is to stay calm. This is not something that you expected, this is certainly not something the patient expected, but you have to stay calm so that everyone in the room stays calm and the patient also stays calm and you can make better decisions if you're able to take a breath and try to salvage the situation.

When you see a posterior capsular violation, you don't want to remove your phacoemulsification probe; if you do that the anterior chamber will shallow and vitreous will come forward, so you want to stay in the eye with your phacoemulsification probe. If you have any vitreous that's incarcerated in your probe you want to reflux that out of your probe and then you want to inject with your other hand through your paracentesis some dispersive viscoelastic. You want to inject that in front of the rupture site and beneath any lens material so that's going to help to tamponade and push back or at least prevent any further vitreous from coming forward, at the same time it's going to provide a barrier to prevent that lens material from migrating posteriorly.

Once you've injected the viscoelastic, then you can slowly remove the phacoemulsification probe, and then I would recommend just closing the main incision even if it's a temporary close. It's better just to have a completely sealed anterior chamber. You will have your paracentesis site that's still open and you're going to create another paracentesis site that's going to accommodate your bimanual anterior vitrectomy setup, so one hand will have the irrigation handpiece and one hand will have the vitrectomy handpiece and while the staff is getting the anterior vitrectomy setup, it's

an opportunity for you to again take a breath, collect yourself, and also administer a little bit of extra anesthesia; the surgery is obviously going to be longer than you anticipated and so you want to make sure that the patient stays comfortable. Doing a little subtenon's block can go a long way to making sure that at least the patient is comfortable through this procedure.

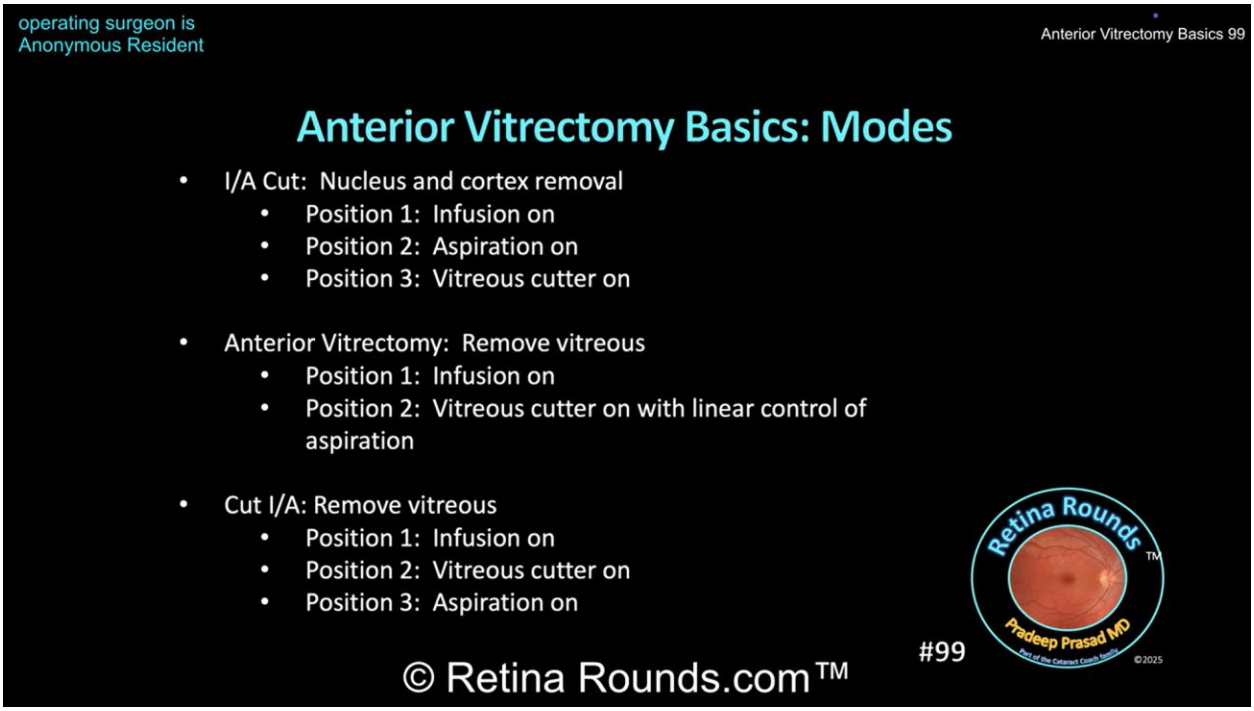


These are some basics on how to perform an anterior vitrectomy. Obviously, one of the key things here is to try to avoid any posterior migration of nuclear fragments. If you do have any nuclear fragments, you want to mobilize those up into the anterior chamber, and tuck them into the angle so that they're less likely to fall back, then you want to remove any vitreous that's migrated anteriorly, you need to clean up all of that anterior vitreous so that you can maybe put IOL in the sulcus, and in order to see the vitreous you have to stain it. You want to consider putting in some more viscoelastic to push any vitreous back, you want to try to decrease the likelihood for more vitreous coming forward but you should also use triamcinolone to stain the vitreous. TA is going to allow you to see it much better, and I would recommend using a 1:4 dilution or even a 1:5 dilution of TA. You just need a light dusting of the vitreous, you don't want to have big clumps of TA that's going to actually obscure your view. Now once you've tamponed the vitreous and stained it, you can then use your bimanual anterior vitrectomy setup to remove the nuclear and cortical remnants and we'll get to what setting to use on the machine in just a moment and once you've removed those nuclear and cortical remnants then you can remove any vitreous that is migrated anteriorly.

Some pearls when performing an anterior vitrectomy: Now with one hand you're going to be irrigating, you're going to be infusing BSS into the anterior chamber and you want to keep that irrigation level lower so that you're not overly deepening the anterior chamber, you're not pushing a lot more BSS into the posterior segment that's going to encourage it to hydrate the vitreous. It's going to encourage it to come forward and you want to try to point the irrigation hand piece away

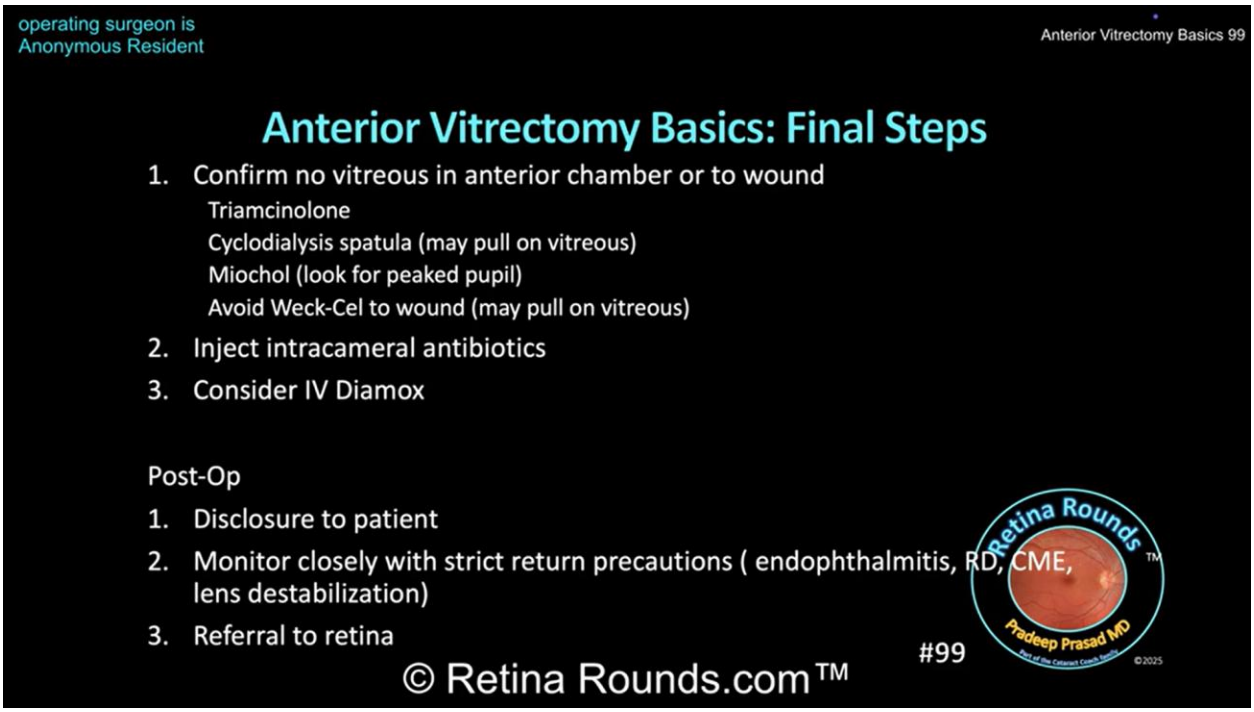
from the capsule rupture, again trying to decrease the likelihood of hydrating the vitreous or encouraging more vitreous from coming forward. When you are using your vitrectomy handpiece in the other hand you want to keep that vitrectomy port up towards the cornea. You don't want to point it down to the posterior segment that's just going to draw more vitreous up. You just want to clean up the vitreous that's in the anterior chamber, so start by keeping the vitrectomy port up towards the cornea and then you can tilt it at a 45°, even a 90° angle to try to engage any of the vitreous that's in the anterior chamber. While you're moving around with the vitrectomy handpiece move slowly; you don't want to do any sudden movements, use the fluidics of the vitrectomy handpiece in your favor, let the vitreous come to you, when you see that the vitreous is no longer coming to the handpiece, then you can move the hand handpiece towards the stained vitreous and you want to be careful as you're moving that hand piece around that you are very careful around the iris. If you're using a high vacuum, iris can easily pop into the mouth of the vitrectomy handpiece and you'll have an iris defect, so just be careful as you're cleaning up around the iris.

If you are in the process of removing nuclear or cortical fragments and some of those fall back, don't go chasing after them, you're just going to create more problems in the posterior segment. It's just going to worsen the patient's outcome. At that point if pieces fall to the back and if they're nuclear pieces or significant pieces of cortex, you'll just have to refer this patient to a retina specialist to perform a complete vitrectomy. Chasing after those pieces through an anterior approach is just going to be a setup for a retinal tear and potentially a detachment. Again you want to be patient with the vitrectomy, go slowly, this isn't a race, just be thorough in cleaning up all the vitreous that's in the anterior chamber, and you'll know that there's vitreous that's in the anterior chamber not only through the staining with TA but if you hear a ding, that occlusion ding on the machine you'll know that vitreous is still present.



So, let's talk a little bit about the settings on the foot pedal. You have basically three basic modes: I/A cut, anterior vitrectomy and cut I/A.

Let's start with I/A cut. I/A cut is what you're going to use to remove nucleus and cortex material. So, position one on your foot pedal is going to turn the infusion on, position two is going to engage the aspiration only on the vitrectomy handpiece, and then position three is going to engage the cutter. So, the idea here is you start in position one to inflate the anterior chamber then with the position two, you can aspirate those nuclear pieces or those cortical pieces into a safe place where then you can go into position three engaging the vitreous cutter and removing those pieces and we'll talk about the specific settings that I would recommend for this step in our next episode. The anterior vitrectomy mode is a little bit different that's really designed for you to be able to remove vitreous. In position one, the infusion is going to turn on, and in position two, the vitreous cutter is going to turn on with a linear control of aspiration. So, as you go down on that foot pedal, you're going to ramp up from zero i.e., no aspiration, up to whatever your preset level is for flow and vacuum. Finally, cut I/A is very similar to anterior vitrectomy except you've got position one infusion on, position two vitreous cutter on, and then position three is where you have your aspiration on. So, I cut I/A and anterior vitrectomy are very similar. Most surgeons opt to just use the anterior vitrectomy, so that as you depress down on the foot pedal, you have linear control of your aspiration.



Just to recap; here some of the final steps: You do again want to confirm that there's no vitreous in the anterior chamber or to the wound, and you can do that through a number of ways; most commonly TA will be injected just to confirm, but you can also use a cyclodialysis spatula to try to sweep near the paracentesis or cordial wounds. The downside of this is that if there is vitreous there, you may be pulling on the vitreous and increasing the likelihood of traction on the retina and potentially create a retinal break. Miochol is another really good idea here that's going to help to constrict the pupil, stabilize a lens if you if you've put in a sulcus lens to keep that lens in place, but also if you see a peaked pupil that can give you a clue that there's still some vitreous that needs to be addressed, and lastly I know that some surgeons use a Weck-Cel to try to test the

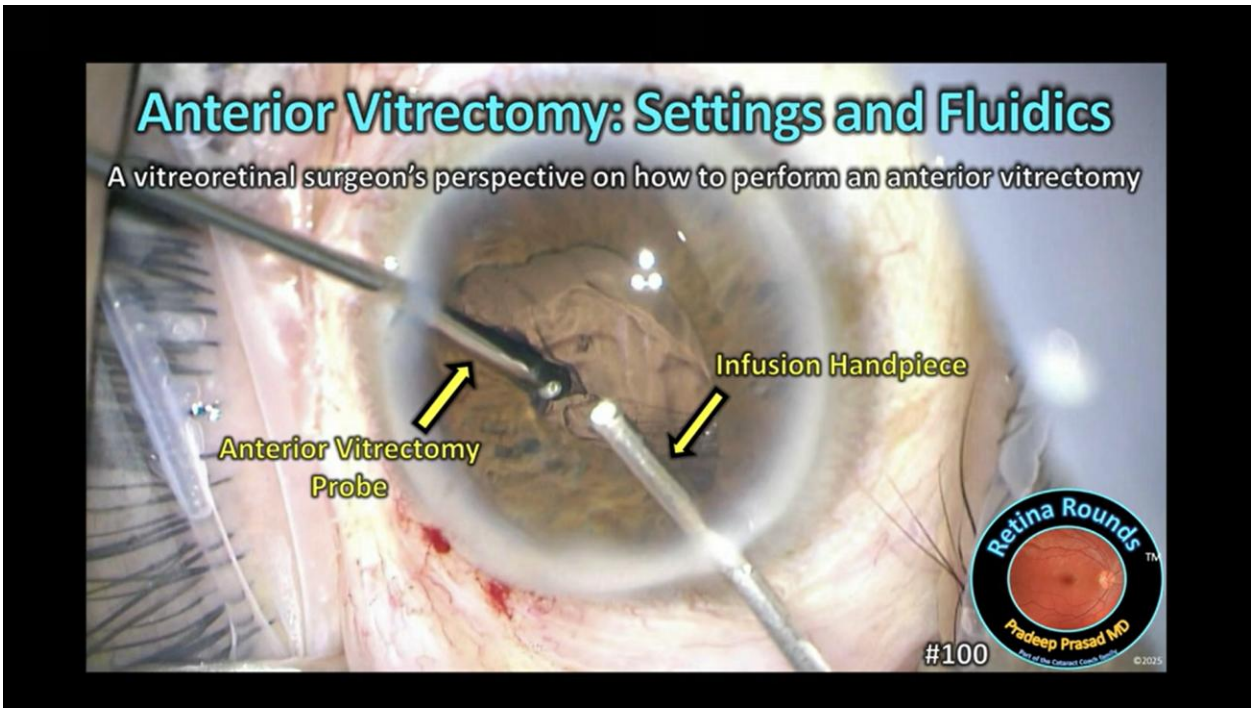
wound to see if there's any residual vitreous but I would advocate against that since if there is any vitreous it could potentially put too much traction on the retina.

In addition to checking for any vitreous in the AC, also a good idea to inject some intracameral antibiotics. Again, the risk for endophthalmitis goes up and that may help to decrease that risk and since both TA and viscoelastic have been injected into the eye and not all of that has been removed typically at the time of anterior vitrectomy you should definitely consider giving some either IV or oral Diamox in the post-operative area to try to decrease the risk for any IOP spikes.

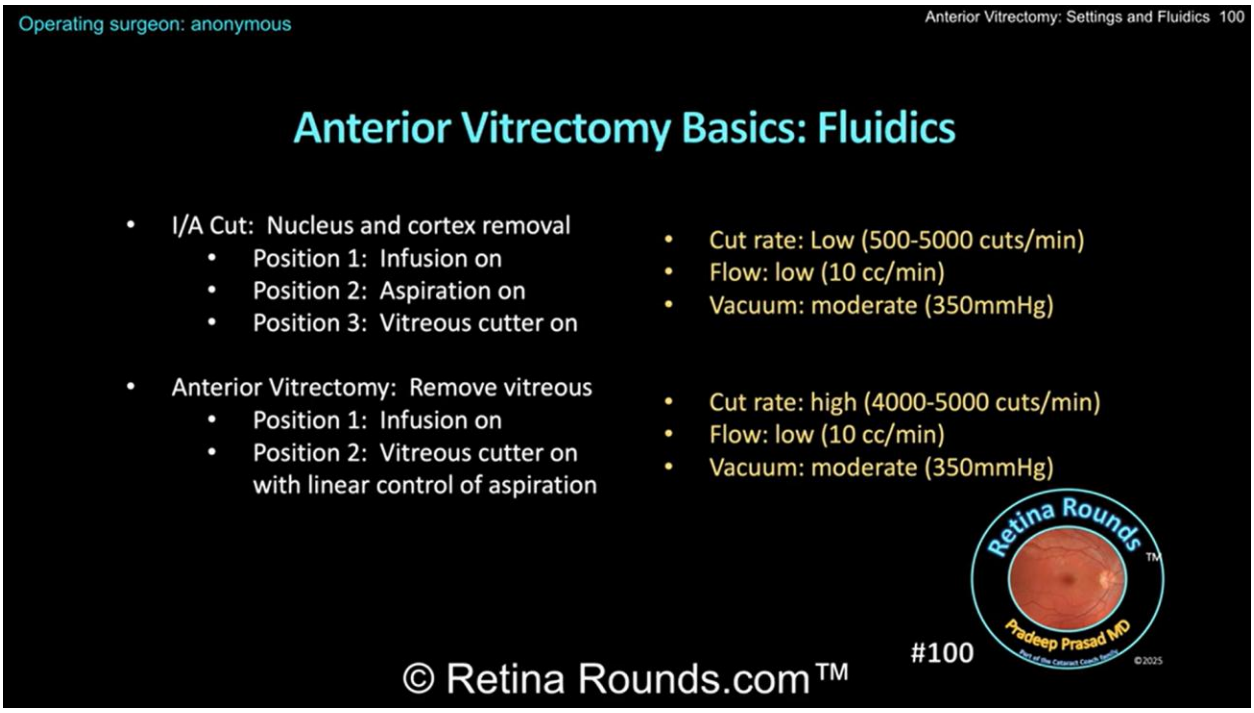
Finally, in the post-operative period, it's important to have a discussion with the patient about what happened. You definitely don't want to keep this a secret, so disclose what happened to the patient, tell them about how you were able to mitigate any further complications and be sure to monitor them very closely in that postoperative period. When complications happen, patients will feel far more reassured if their surgeon is right there by their side, so you want to run towards patients who have complications, you don't want to run away from them, and again you want to monitor them for any signs of endophthalmitis, retinal detachment, CME and lens destabilization. Whenever, there has been a violation of the of the posterior capsule, I would highly recommend referring these patients to a retina specialist, even if there aren't any fragments in the posterior segment. Just a good idea to have a retina specialist on board to thoroughly check the posterior segment and address any posterior segment pathology that may have arisen.

- **Anterior Vitrectomy Settings and Fluidics**

https://www.youtube.com/watch?v=K13r2ZiKhKs



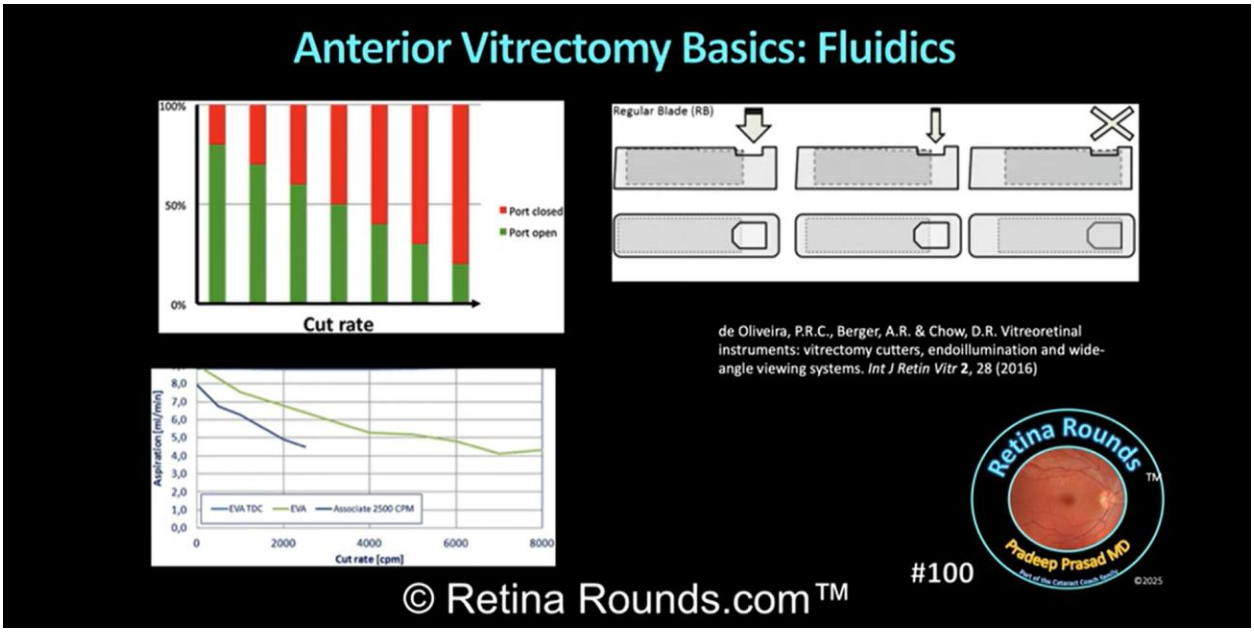
In episode 99, we talked about some of the basic concepts of how to perform an anterior vitrectomy, and in today's episode we're going to review the machine settings and basics of fluidics. So, why do you have to know this well, there's not a one-size-fits-all approach to anterior vitrectomy. In some cases, you may have a lot of nuclear and cortical material remaining, and in other cases you may just have a little bit of cortex or even no cortex at all. You have to be able to understand what you can modulate on the machine to be able to complete the case in the safest manner possible and that's what we hope to achieve today.



Let's just talk a little bit about the settings that you want to use on the machine to be able to remove cortex. You'll remember from episode number 99 that there are two basic modes that you're going to be using either I/A cut or anterior vitrectomy. I/A cut is going to be primarily for nucleus and cortex removal, and anterior vitrectomy is going to be used primarily for removal of the vitreous. So, an I/A cut: Position one is going to be infusion on, position two will be aspiration on, and then position three is when you're going to actually engage the cutter; so, at this stage we're going to be using I/A cut to remove that residual cortical material. So, what are the settings?

Let's actually start by talking a little bit about flow and vacuum: Flow is going to be how fast that fluid is actually moving or a viscous substance is moving through the vitrectomy probe, and then once occlusion has occurred then vacuum is going to be generated that's going to be in a peristaltic pump type system. In a venturi system, you'll just have vacuum to modulate, so you want to try to keep these settings at a relatively low level. You don't want to be aspirating too rapidly because you don't want to encourage more of the vitreous from coming forward. You don't want to remove the viscoelastic that's there tamponading the capsule rupture site from and the vitreous from coming forward. So, you want to keep that at a relatively low rate, and then using the vitrectomy probe you want to try to go close to the cortical material and then engage the aspiration so that you're engaging that cortical material and then you're going to have that vacuum

that's going to ramp up and you can then strip that cortical material away from the residual capsule and bring that up into the anterior chamber where you can safely remove it. Now when you're removing it, that's when you're going to be engaging the cutter.



Let's talk a little bit about the cutter dynamics: So, the way that the cutter works is a guillotine-l like blade.

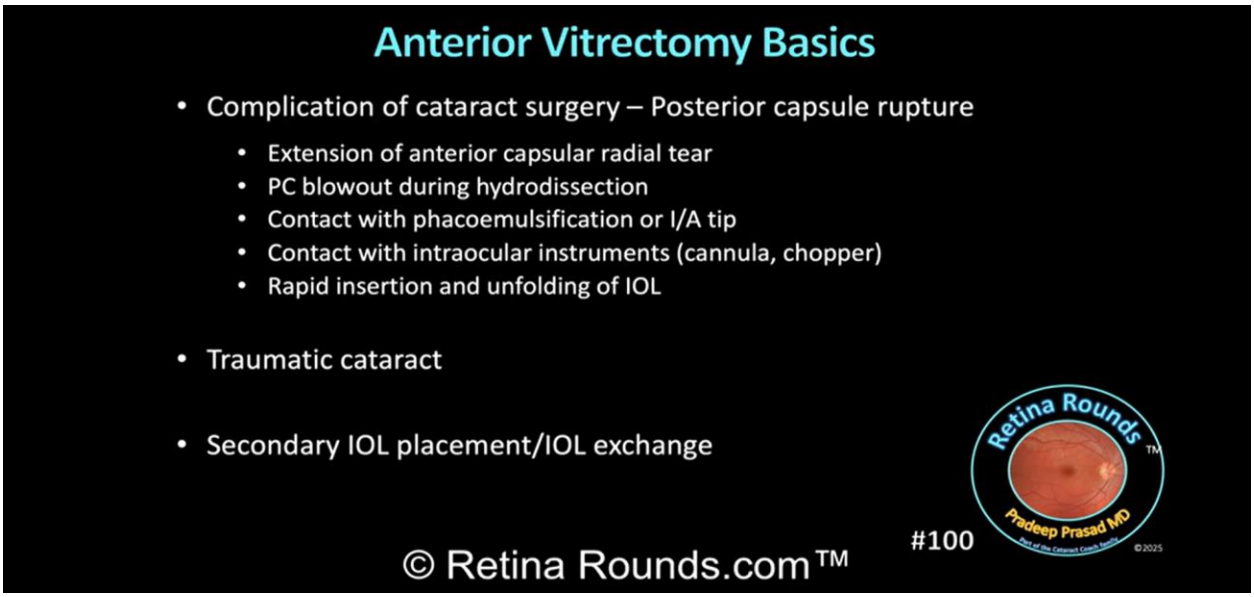
Take a look at the image on the upper right-hand corner: Initially, when the cutter mouth is open, that's where you're going to actually be able to aspirate some material whether that be cortical material, nuclear material, or even vitreous that's going to be aspirated into the probe and then as the cutter engages, it's going to actually act like a guillotine-l like blade, it's going to cut whatever is there, and then it's going to open again to allow more aspiration to occur, and so the faster that your cut rate is, the less opportunity there is for substances to get into the cutter mouth, and the slower that your cutter is, the more open the cutter mouth is, and the more you're going to be able to remove whatever material is there.

Take a look at the upper left-hand corner: This is the duty cycle. So, as you go up on the cut rate, the amount of time that the port is closed actually goes up right. So, in a at a very high cut rate, your port is not going to be open, you're not going to be engaging as much material but when you're moving cortex or you're moving nuclear material, you want that port to be open because you want to get that material in and out into the vitrectomy probe, and then out of the eye. So, this is the reason why we like to keep the cut rate relatively low. It's going to allow us to better engage that material especially if you're talking about some nuclear chips that are remaining; those can be pretty hard, and so you may not be able to actually aspirate and remove that material so keep the cut rate relatively low and you can modulate the cut rate depending on how dense the material is that you're trying to remove.

if you look at the bottom left hand panel, you can see that as the cut rate again goes up, the aspiration flow of fluid or whatever substance it is in the eye whether that be fluid or more viscous

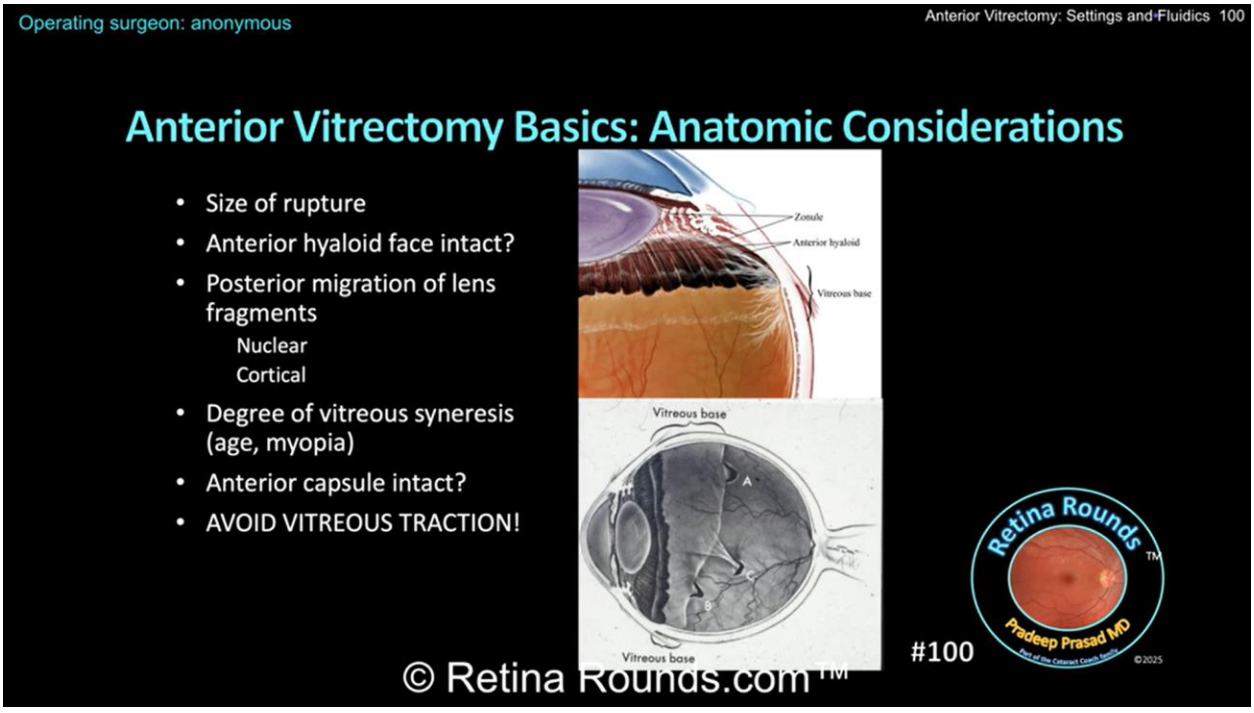
material goes down. So, again the higher the cut rate, the less flow, the less removal of material that you're going to have, and that's advantageous when we get to vitrectomy later on because we don't want to be pulling on vitreous too hard but when we're trying to remove the cortex or the nuclear material we want that to come out more readily and so that's the reason for keeping the cut rate relatively low. For denser material, you can certainly ramp up on the cut rate even up to the maximum of 5,000 cuts per minute for a really light friable material like just a little bit of residual cortex but you generally want to keep the flow and the vacuum levels at a low to moderate level, so that you're not removing material too quickly and potentially encouraging more vitreous to come forward.

Our next step is to remove any residual vitreous that has come or may have come forward up into the anterior chamber, and so we want to switch our mode here to anterior vitrectomy to remove the vitreous: Position one here is going to be infusion on, position two the vitreous cutter is going to be engaged and, then as you further depress down that's going to give you linear control of your aspiration and here with removal of the vitreous, you want to keep your cut rate as high as possible and so the usually the max on modern machines is going to be somewhere in the 4,000 to 5,000 cuts per minute range and then again you still want to keep the flow relatively low, the vacuum at a low to moderate level, again you can modulate depending on how far down you are on the foot pedal, you can modulate how much flow or how much vacuum you're engaging and so this is very similar to the shave settings that we would we would use in posterior vitrectomy. When we're shaving back the vitreous proximal to the vitreous base, we don't want to exert a lot of traction on that vitreous base. We want to decrease the likelihood of creating an iatrogenic retinal break, and that's kind of the same concept that we want to use with vitreous removal, we want to keep that cut rate really high. Remember, going back to that diagram or those graphs that we showed you earlier: with the high cut rate, actually the duty cycle goes down, the efficiency of the cutter goes down, the flow goes down and that's to your advantage, here because you want to try to nibble away very carefully and slowly remove whatever vitreous is there, you don't want to be pulling on it as pulling on the vitreous is going to increase the likelihood of having a retinal break.



There are a number of reasons why you might need to perform an anterior vitrectomy: This might be because of a complication of cataract surgery, that's going to be the most common reason with a posterior capsule rupture and there are a variety of reasons why posterior capsule rupture can occur: It could be because of an extension of an anterior capsular radial tear, a posterior capsular blowout during hydrodissection and that's going to be a little bit more common in dense nuclei, and cases where there's a smaller capsulorhexis during phacoemulsification, the contact of the phacoemulsification tip or even the I/A tip to the posterior capsule can cause it to rupture, certainly contact with intraocular instruments whether that be cannulas that are used to inject viscoelastic or BSS, the chopper, all of that if it's not done carefully can damage the posterior capsule, and then lastly when the lens is being injected if that's done too rapidly, the unfolding of the IOL haptic into the anterior chamber not done carefully, the haptic can snag on the capsule and potentially also cause a posterior capsular rupture.

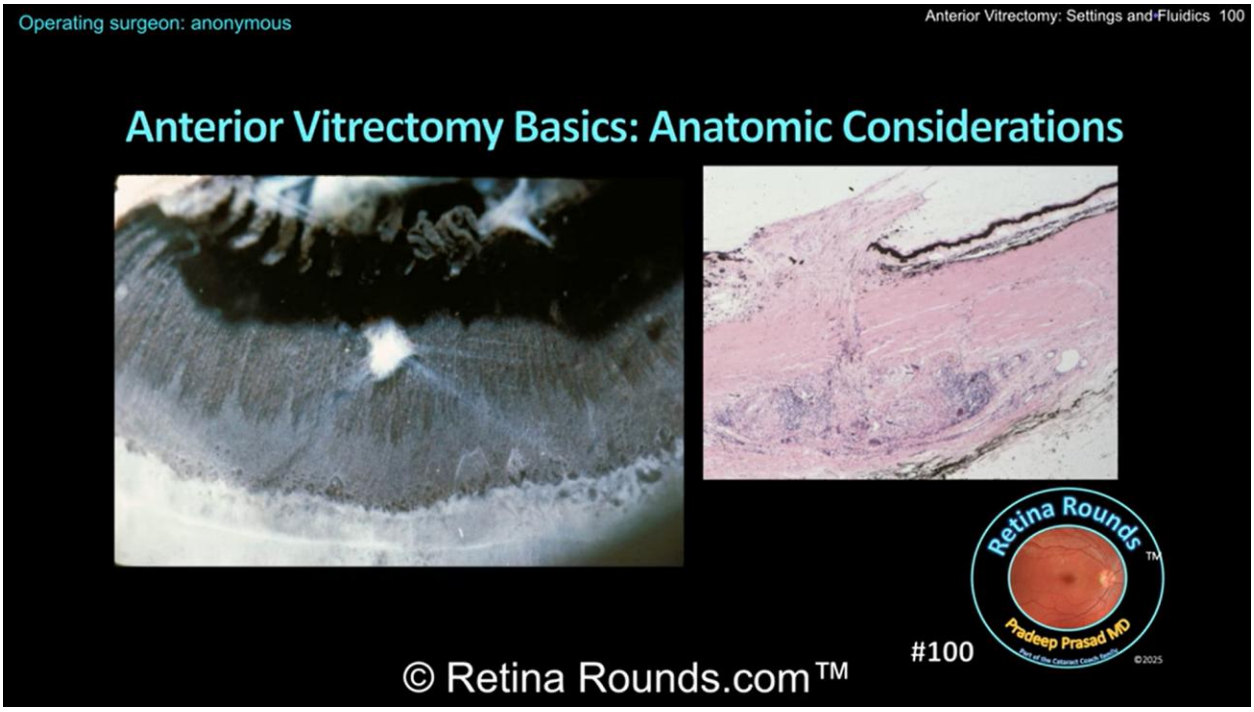
There are other reasons other than complications from cataract surgery that you might need to do an anterior vitrectomy: There are cases where there might be already capsular violation or a a compromise of the capsule. For example, in a traumatic cataract or maybe in cases where you're trying to do an IOL exchange and the patient's already had a YAG capsulotomy, exchanging out that lens does increase the risk for potentially vitreous coming forward, so you have to be prepared to be able to do an anterior vitrectomy.



When a posterior capsular rupture occurs, you want to think about the anatomy here.

First of all, think about the size of the rupture: The larger the rupture size, the more likely it is for vitreous to come forward. Now just because there is a capsule rupture that doesn't necessarily mean that vitreous will come forward, in younger patients or if you're lucky if the capsule rupture was very superficial, the anterior hyoid face may still be intact and so the vitreous from the

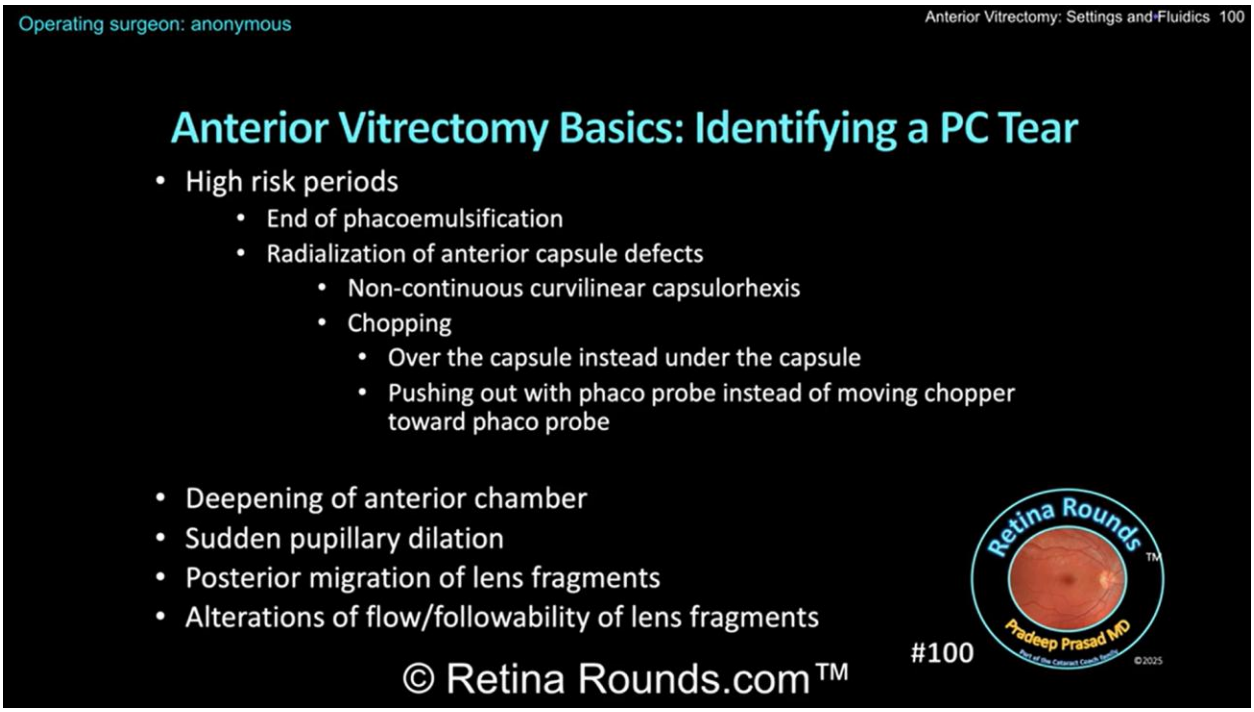
posterior segment may not migrate anteriorly. Now with a capsule rupture, the biggest concern is going to be posterior migration of lens material and you want to know whether that material is nuclear or cortical; if it's nuclear, most likely the patient's going to need to have a vitrectomy, if it's just a little bit of cortical material, sometimes that can be watched but either way you want to make sure that you're monitoring this patient in conjunction with the retina specialist, so that they can also not only make sure that the retina is okay, there's not any retinal tears or detachments, but if intervention is necessary the patient's going to be set up to have that intervention done more rapidly. The other thing to consider here is the degree of vitreous syneresis. Liquefied vitreous is going to be more likely to come forward with a posterior capsular rupture, and this is going to be more likely in older patients as well as in patients who are myopic. Lastly, you want to make sure to understand whether or not the anterior capsule is intact because if the anterior capsule is intact then you might still be able to put a sulcus lens in place. Throughout this process of evaluation and then performing an anterior vitrectomy always remember that your goal is to reduce vitreous traction and we've talked about a variety of ways that you can do this using the fluidics of the vitrectomy system, again keeping the aspiration relatively low, so low flow, low vacuum and when you're removing vitreous keeping that cut rate as high as possible so that it's not pulling on the vitreous too much.



Some surgeons advocate for performing a pars plana vitrectomy. The idea here being that rather than pulling more vitreous anteriorly \ with the probe in the anterior chamber, why not go into the pars plana and then perform the vitrectomy so that you're actually having the cutter mouth pointed up in the pars plana position and actually pulling any anterior vitreous back down and that does make good sense but the biggest concern that I have as a VR surgeon is that when putting instruments into the pars plana and you don't have good visualization, you may run into problems. So in these eyes, the eye pressure may be low, the patient may have a small choroidal that you're unaware of, and even if this type of pathology is not present, when you're performing the

vitrectomy you can't do a complete vitrectomy, you're only going to be doing a vitrectomy primarily in the visual axis or where you can see based on the pupillary dilation, but you're not going to be able to shave the peripheral vitreous and what will happen is when that trocar comes out the vitreous is going to incarcerate in those sclerotomy sites, and the more vitreous that incarcerates the more potential traction there can be on the anterior vitreous and the vitreous base and there can be retinal breaks that can occur.

Here's a histopathology picture as well as a gross anatomy picture that you can see here of a patient that's already undergone a pars plana vitrectomy but you can see here even with relatively thorough cleaning of the vitreous through a pars plana approach, you can see that there's vitreous incarceration and fibrosis that happens and that fibrosis of course is going to contract and pull on the residual vitreous and potentially create a break so this is the reason why as a vitreoretinal surgeon, I'm not a big fan of performing a pars plana approach because that lack of being able to perform a complete vitrectomy might increase the risk for vitreous prolapse into the sclerotomy and potentially increase the risk for traction and retinal breaks.



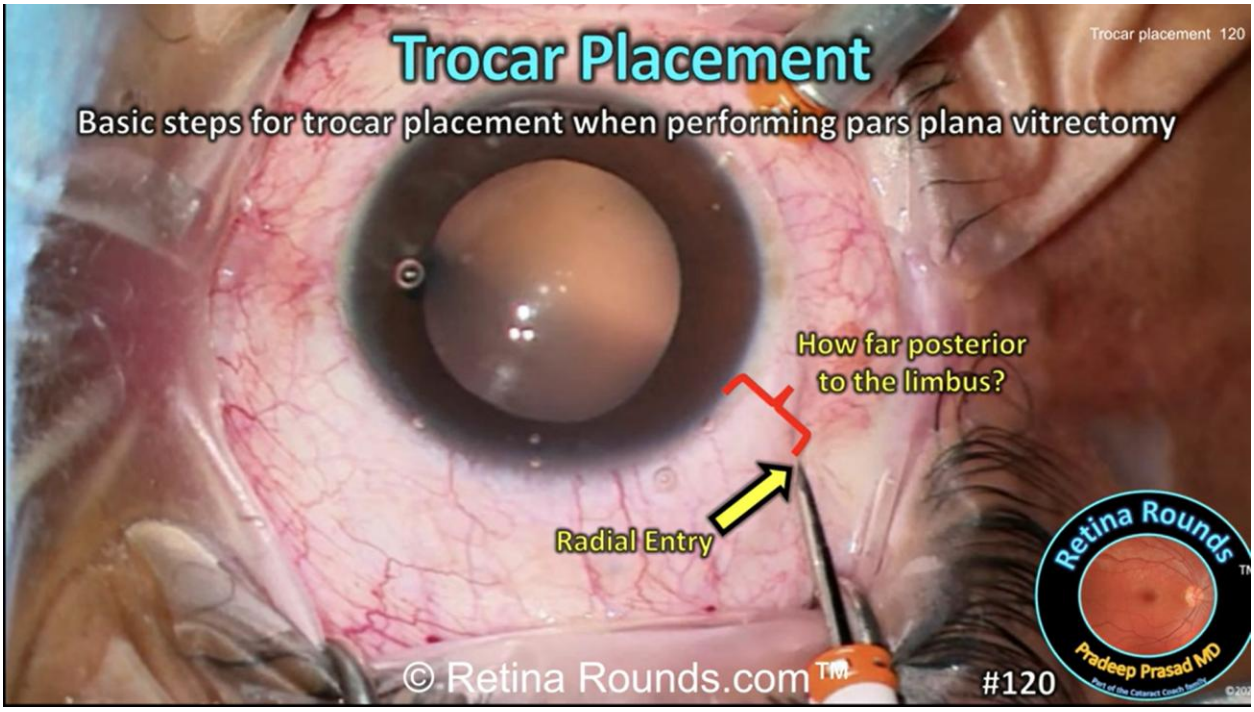
One last thing that I want to talk about some of the points in cataract surgery where you're going to have a higher risk of developing a posterior capsular tear: One is going to be at the end of phacoemulsification, when you don't have a lot of nuclear material in the bag, that bag is going to be a little bit more mobile and particularly with that maybe if you're doing a divide and conquer for example and you're removing that last quadrant of lens material, that's where the capsule is going to be the most mobile, and potentially can jump into the phacoemulsification probe, so you want to make sure that you're using your chopper a or a second instrument to hold that posterior capsule back while you're removing those last bits of nuclear material, of course this can happen during radialization of anterior capsule and that can happen when there's a sort of a non-continuous curved capsulorhexis. can also happen you can get anterior capsular defects when

you're chopping, so if you're not careful to make sure that your chopper is fully underneath the capsule, you may actually inadvertently cut or chop the anterior capsule, and then that can radialize around and result in a posterior capsule rupture. Also, when you're chopping if you're not moving the second-hand piece, the second instrument towards the phaco handpiece but rather you're moving your phaco hand piece out towards the periphery out towards the chopper that's where that sharp tip of the phaco probe might nick the capsule and could cause a radialization and a posterior capsular rupture.

One last thing to keep in mind is identifying posterior capsular ruptures early because when you identify it earlier you can start to get vitrectomy machine set up, you can you can remove that residual or at least mobilize that residual lens material into safe positions so that it doesn't go back posteriorly, and so what are the signs of a posterior capsule rupture? If you see a sudden deepening of the anterior chamber, if there's a sudden pupillary dilation, if there's a posterior migration of lens fragments, or if you start noticing that the followability, the flow of the lens fragments just isn't behaving as it once did, you need to be a little bit more vigilant for the possibility of a posterior capsule rupture, and if you can identify that early you're going to be able to potentially prevent any posterior lens migration, and then get yourself set up to remove that vitreous and again minimize the amount of vitreous traction and hopefully decrease the risk of a retinal break. So, that wraps up our review of anterior vitrectomy. We hope that you found this to be useful.

- **Trocar Placement Basics**

Link: https://www.youtube.com/watch?v=nBSleBS9GrM



In this episode we will cover the basics of trocar placement for vitreoretinal surgery as well as a discussion of considerations for special surgical scenarios.

Trocar placement is typically done in 4 steps:

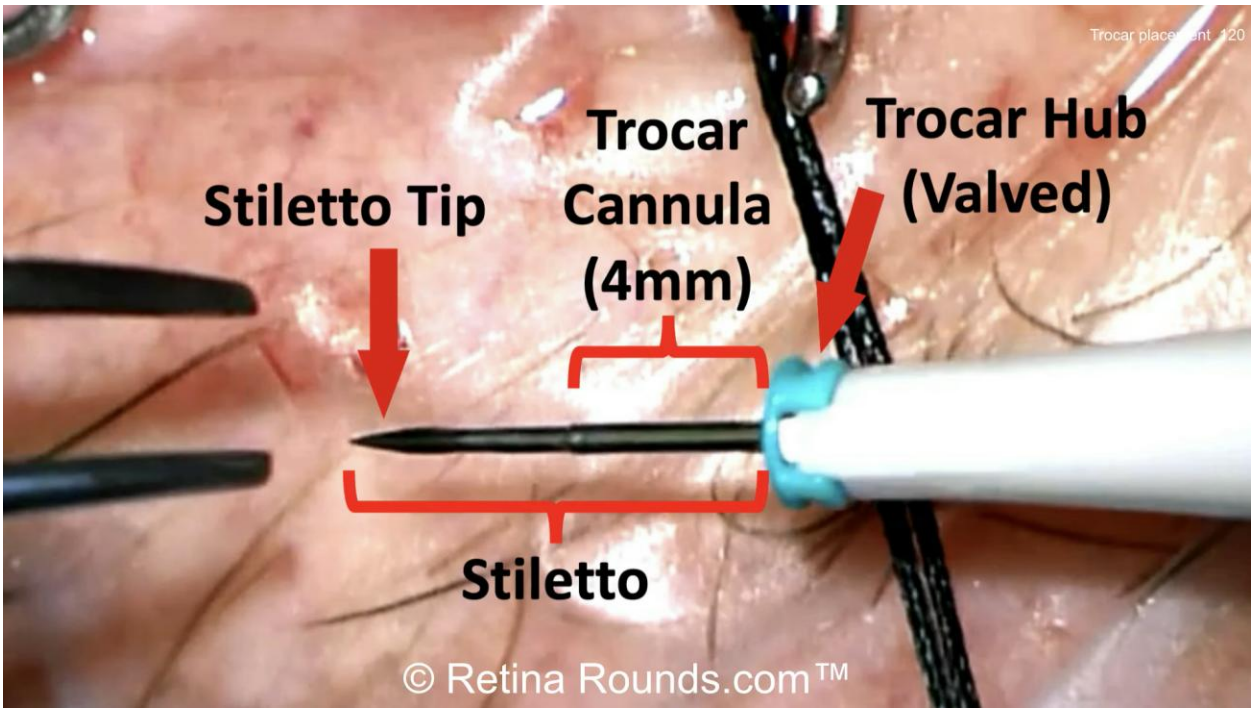
1) Displace the conjunctiva (this will ensure that the sclerotomy is covered by conjunctiva thereby decreasing the risk of infection)

2) Mark the entry location from the limbus (this is done with the back end of the trocar placement handpiece which has markers that indicate a distance 3mm and 4mm from the limbus)

3) Create a radial sclerotomy and advance the stiletto of the trocar placement handpiece parallel to the limbus in a beveled fashion approximately 20-30 degrees from the conjunctival surface

4) Once a partial thickness, beveled sclerotomy has been created, the entry is redirected to the mid-vitreous or posterior pole to place the trocar at the pars plana and the trocar hub flush with the scleral surface. In routine cases, a 3-port pars plana is performed with one trocar in the inferotemporal quadrant (used for the infusion line) and two additional trocars at approximately the 2 o'clock and 10 o'clock positions.

Thank you to the Retina Rounds community for sharing the cases presented in this episode!



Let's talk about the trocar itself. You can see here the hand piece that holds the trocar. The trocar now is being slid off of the blade of the handpiece, which is the stiletto. You can see that the trocar itself has a hub to it, in that hub is a valve. In this particular trocar, the valve is internal to the trocar itself. It can be replaced on the handpiece, and you can see that there's a specific orientation where that trocar sits snugly with the handpiece.

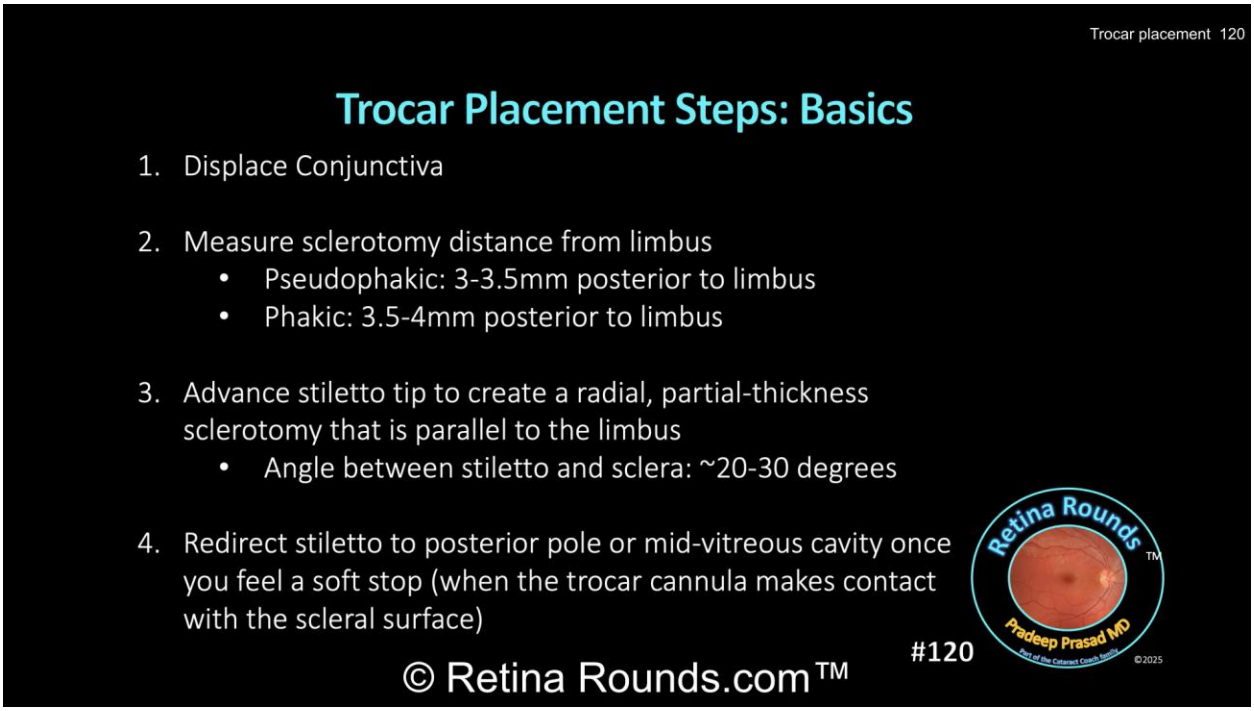
So, let's go into the trocar placement handpiece in a little bit more detail. So, you can see at the end of the white handpiece is an integrated shaft and blade, and this is the stiletto. The stiletto tip is the sharp and flattened end and is essentially very similar to the traditional MVR blade. The tip is what's going to allow you to penetrate through the conjunctiva and sclera before entering the vitreous cavity through the pars plana. The shaft of the stiletto is cylindrical around which the trocar is being held.

Now the trocar itself consists of two components. There's the canula and this is the channel that gives you access to the pars plana and through which instruments can be passed. Now standard trocars have a 4-mm canula length although there are 6 mm trocars available for certain scenarios. The hub of the trocar here is sitting flush with the trocar placement handpiece, and for this system, it's turquoise in color. The hub of the trocar sits on top of the sclera. It prevents the trocar from advancing too far into the eye. It also has an associated valve to keep the eye closed system during vitrectomy. You should note that there are valveless trocars that are available and those can be used based on surgeon preference. Now, one last point here. You'll notice that the trocar canula itself doesn't span the entire distance of the stiletto, and this of course is to keep the stiletto tip exposed because that's what's going to be cutting through the tissue. It's going to allow the trocar to be placed into the eye. As the stiletto tip and part of the shaft penetrate the sclera, the surgeon will feel a soft stop where the cannula of the trocar makes contact with the eye, and this is the point at which the stiletto should be redirected into the vitreous cavity to create a beveled incision.

When placing the trocar, you want your incision to be oriented radially from the limbus. So, you want the wider part of that stiletto blade to be oriented radial to the limbus.

On the back end of the trocar placement handpiece, you can see that there's a caliper which is going to allow you to measure the appropriate distance from the limbus to place your trocar. Now when placed perpendicular against the ocular surface that caliper will make small marks in the sclera and that can help you visualize where to enter the eye. The distance shown here is 3 mm.

The distance shown here is 4 mm.

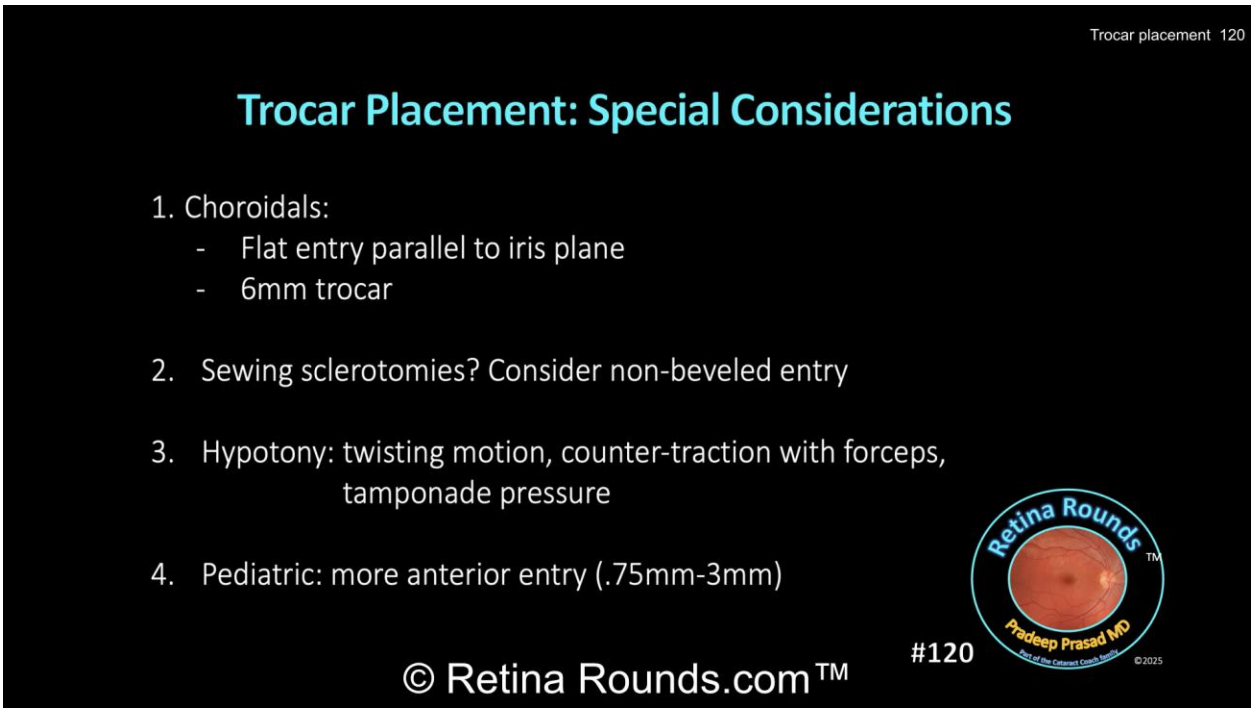


There are four basic steps for trocar placement. First you want to displace the conjunctiva and the reason for this is that at the end of the case when you remove the trocars, you want the uncut conjunctiva to slide back over the sclerotomy site to potentially decrease the risk for endophthalmitis.

Now next with the caliper on the back end of the trocar placement handpiece, you want to measure the appropriate distance from the limbus to create your sclerotomy, and you want that sclerotomy to be in the pars plana but a safe distance from the lens. In pseudophakic eyes, will be about 3 to 3.5 millimeters from the limbus, and in phakic eyes will be between 3.5 and 4 millimeters from the limbus.

Now to create the sclerotomy, you want to advance the blade or tip of the stiletto radially oriented from the limbus and following a path that's parallel to the limbus. The stiletto should be about 20 to 30° of an angle from the scleral surface in order to create a beveled partial thickness scleral incision. The beveled incision is important since it's more likely to be water or airtight and can decrease the need for suture closure of the sclerotomy at the end of the case.

Now, as you're advancing the stiletto through partial thickness scar, you will feel a soft stop and this is where the trocar canula is making contact with the scleral surface. At this point, you want to redirect the trajectory of the stiletto so that it is directed towards the mid vitreous cavity or the posterior pole. Once you've advanced the handpiece until the trocar hub is flush with the scleral surface, you can then hold the trocar with the forceps and then withdraw the stiletto.



Now there are some scenarios where you want to make some modifications to your trocar placement.

One example would be in the presence of choroidal detachment. So, when a choroidal detachment is present that can create a little bit of a narrower space to safely place the trocar, and you want your entry to be a bit flatter parallel to the iris plane so as to not touch the stiletto blade itself or the trocar to the area of the choroidal detachment. You can also consider using a longer trocar, a 6-mm trocar as opposed to the standard 4-mm trocar in cases where you're worried that the choroidal detachment is creating a bit of a boggy or thickened pars plana, therefore the tip of your trocar may not fully be within the vitreous cavity. This is particularly important for the infusion line trocar.

Now, we showed you a beveled entry for these cases, and there are scenarios where you may want to consider doing a non-beveled entry. That might include eyes where, you're going to be sewing the sclerotomies closed, and so perhaps having the beveled incision is not as critical. I generally still like to create beveled incisions even if I know that the sclerotomies will be sewing because if I'm using some sort of a tamponade agent whether that be gas or oil, I like to have a minimal loss of that tamponade substance as I'm withdrawing and removing the trocars.

Now sometimes placement of the trocars can be a little bit more challenging in eyes that are hypotonus. So, when pushing the trocar or the stiletto into the eye, it can sometimes distend the scleral surface quite significantly. To avoid this, you can use a twisting motion as you're advancing the trocar. You can certainly go up on the pressure of the infusion line. You can use a tamponade pressure or you can also hold the scleral surface and create some counteraction as the stiletto and the trocars are being advanced into the eye.

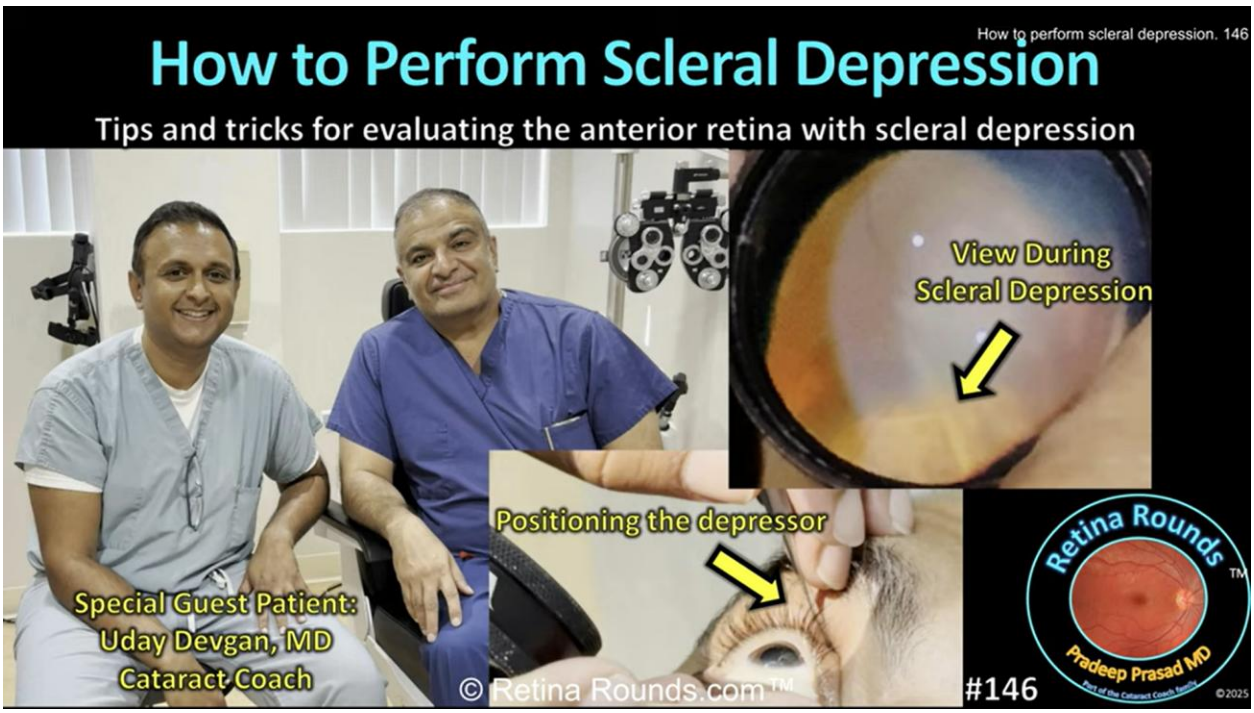
Lastly, I would just say for pediatric patients, you want to have a more anterior entry for the trocar than in adult eyes and that will depend on the age of the patient but generally speaking, it's going to be somewhere in the 0.75-mm to 3-mm posterior to limbus. Again, depending on how old the child is and where the pars plana is most likely to be located. Wright LM and his colleguse provided age-based recommendations for sclertomy placement. (Wright LM, Harper CA 3rd, Chang EY. Management of infantile and childhood retinopathies: optimized pediatric pars plana vitrectomy sclerotomy nomogram. Ophthalmol Retina. 2018;2(12):1227-1234).

Age	Distance from limbus (mm)
<1 month	0.75
1-3 months	1
3-8 months	1.5
8-12 months	2
18-24 months	2.5
3-6 years	3
6-12 years	3.5

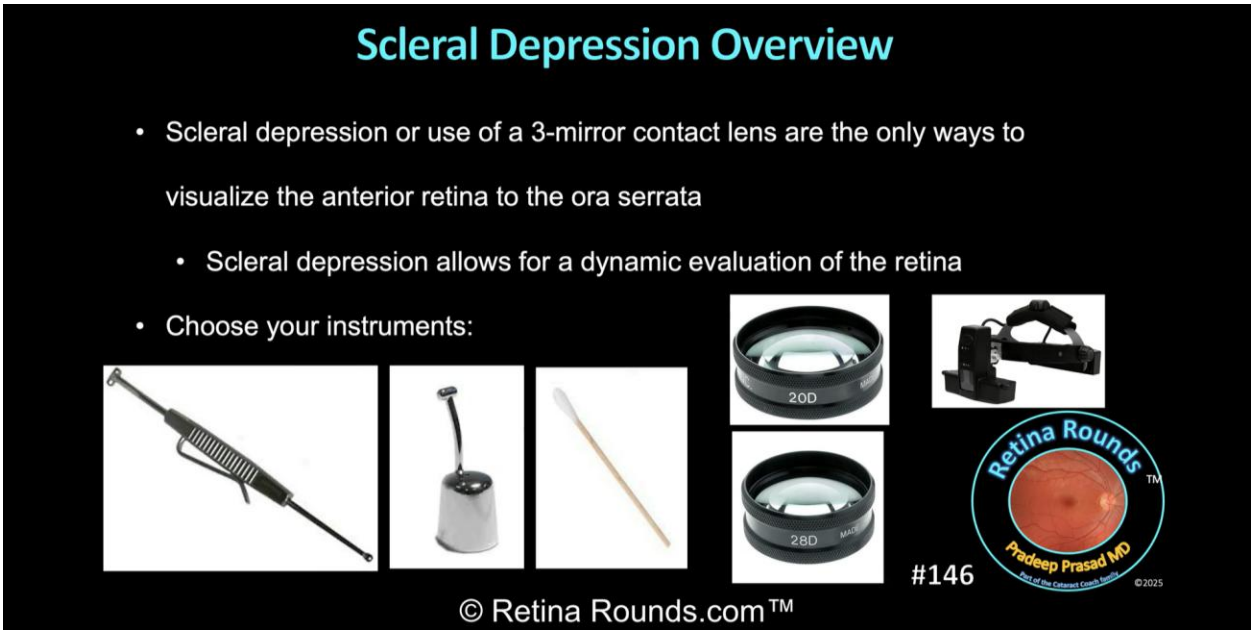
So that completes our review of the basics of trocar placement. I hope you found this review to be helpful and thanks so much for watching.

- **How to Perform Scleral Depression**

Link: https://www.youtube.com/watch?v=dkK2uct_ib8

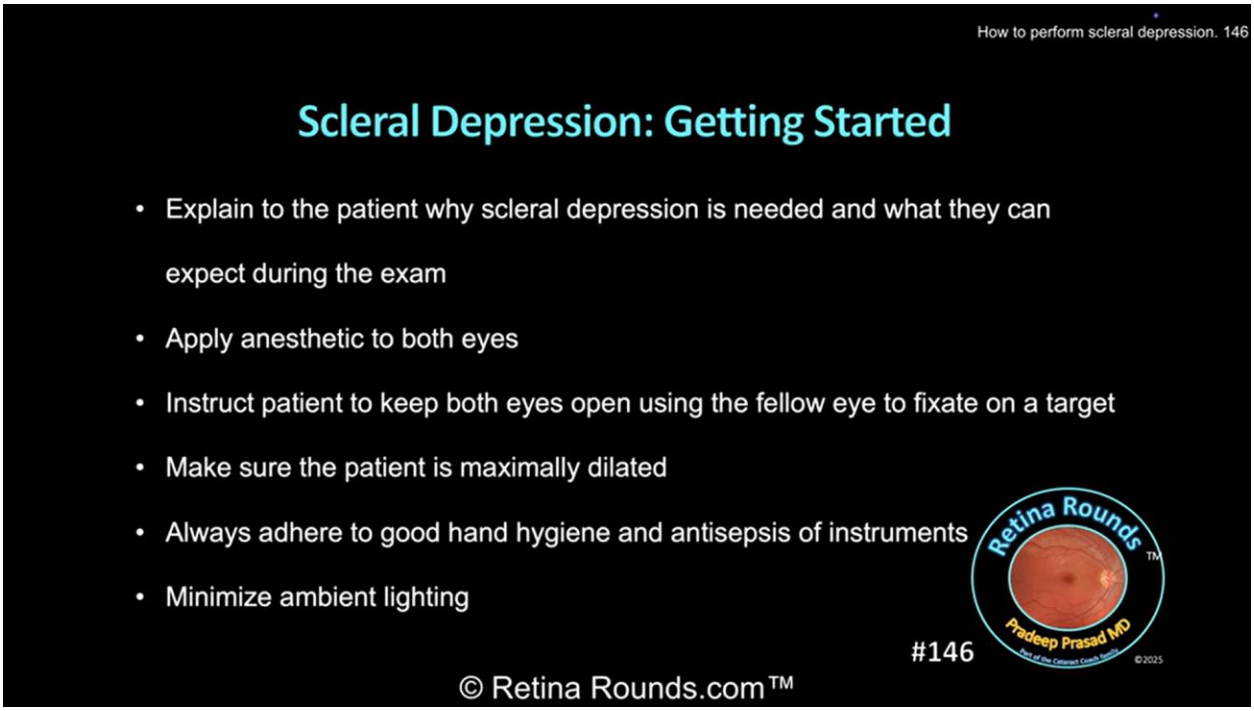


Fundoscopy with scleral depression is a critical skill for eyecare providers to be comfortable performing. In this episode we will cover the basics of this technique and provide some pearls for success. Our very special guest is the Cataract Coach, Dr. Uday Devgan. Dr. Devgan graciously offered to be our patient for this video and we want to thank him. We also want to thank my colleague and Retina Rounds contributor, Dr. Kirk Hou, for videoing the examination.



So why does every eye care provider need to know how to perform scleral depression? Well, it's the only way aside from using a three mirror contact lens to get visualization of the anterior retina and vitreous space up to and beyond the ora serrata. This is the area where retinal breaks most often occur. The added benefit of scleral depression is that it allows for dynamic visualization of the retina; as the depressor is moving anteriorly and posteriorly. Oblique viewing of the retina can allow for identification of small breaks that would otherwise be missed. Now, learning how to perform scleral depression takes time and practice, and this video serves to lay the basic groundwork for success.

First, you have to choose your instruments. The two most common types of scleral depressors are the Schocket double-ended scleral depressor shown in the bottom left corner and the Thimble style scleral depressor next to it. Most surgeons use a Schocket style depressor and the end with the wider bar is used most commonly for scleral depression exams. The choice between the Schocket and Thimble style is largely based on surgeon preference. I've used both of them and found them to be equally effective. Now, if you don't have a scleral depressor available, another option would be to use a cotton tipped applicator. The downside of the cotton tip is that it is a bit larger and may be harder to position posteriorly for patients with shallow orbits. Despite the softer tip of the cotton tip, in my experience, most patients find the smaller size of the metal scleral depressor to be more comfortable. You'll also have to choose a lens for indirect ophthalmoscopy. My preference is to start with the 28-diopter lens, which gives an easier peripheral view, although the image is less magnified. If I need to investigate areas in more detail, I'll switch over to the 20-diopter lens, but ultimately the choice of lens is going to be up to surgeon preference.

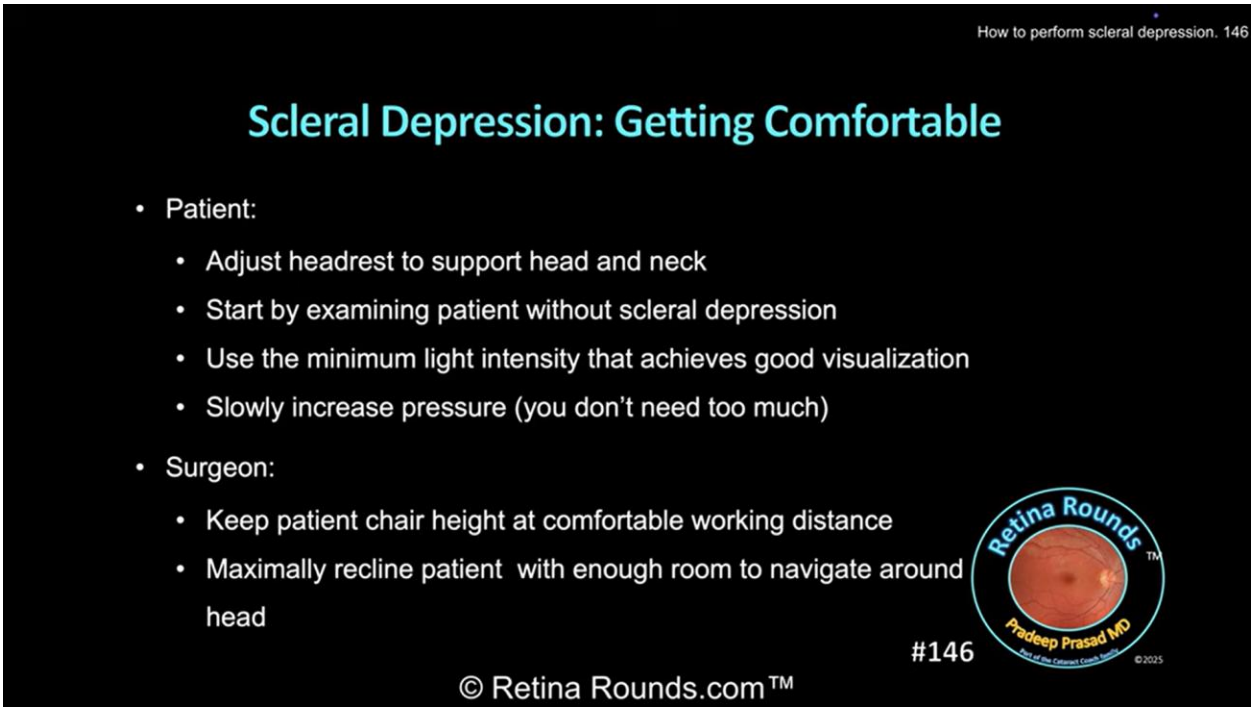


The first step to be successful with scleral depression is communicating with the patient. Often patients who present with acute onset of floaters or other visual symptoms concerning for retinal

tear or detachment are very anxious. Your role as a physician is to allay that anxiety. Be calm and patient.

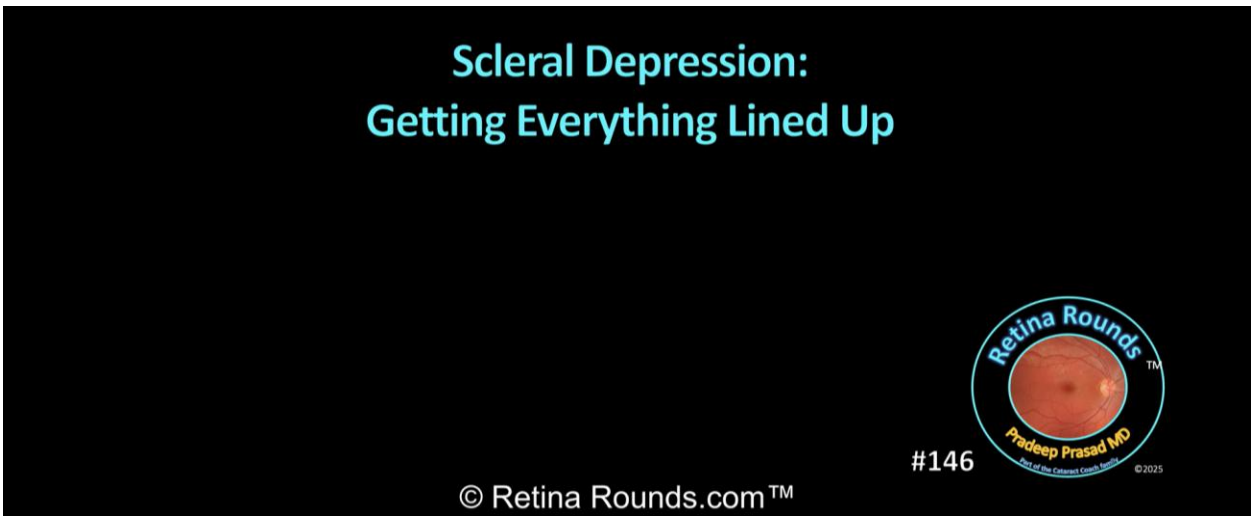
I start by explaining to the patient why scleral depression is necessary and I prep them for what to expect. I tell the patients that the light will be bright and they'll need to keep both eyes open to make sure that they're looking in the correct direction. I also tell them that they will feel pressure during the examination, but they shouldn't feel pain. If they feel pain, I ask them to let me know so that I can adjust the amount of pressure. I also let them know that we can take breaks as needed. I recommend applying topical anesthetic in both eyes, even if you're only depressing one eye, since this will make it easier for the patient to keep both eyes open during the examination. Keeping both eyes open is critical since closure of one eye can result in loss of fixation in the desired gaze direction.

You want to make sure that the patient is maximally dilated to make the examination easier. Of course, you always want to maintain good hand hygiene and antisepsis of your instruments. You want to keep the room lighting to the lowest level possible to maximize contrast and decrease glare. A little bit of ambient lighting can be helpful, however, to allow patients to better fixate.

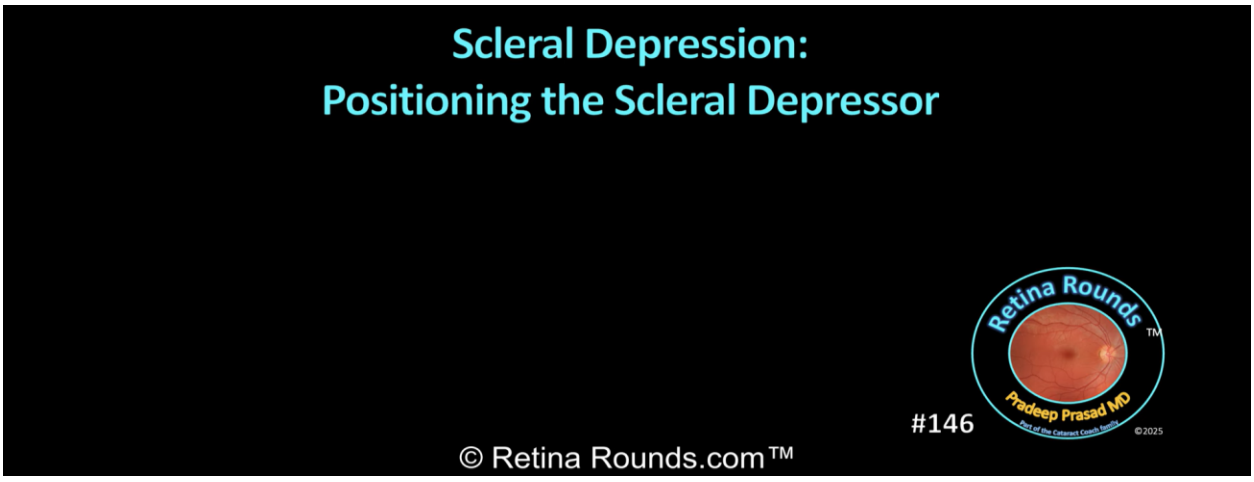


The next thing that you want to do is to make yourself and your patient comfortable. Adjust the headrest so that the patient's head and neck are supported. Start by examining the patient without scleral depression since this will give the patient an opportunity to become comfortable with a bright illumination before applying a pressure to the globe. When it comes to illumination intensity of the indirect ophthalmoscope, you don't need it to be at the maximum level to begin with. Start at the minimum level that you need to get a good view of the retina. As the patient gets more comfortable, you can slowly increase the intensity. And last, when you're performing scleral depression, don't suddenly push with force on the eye. Rather, slowly increase the amount of

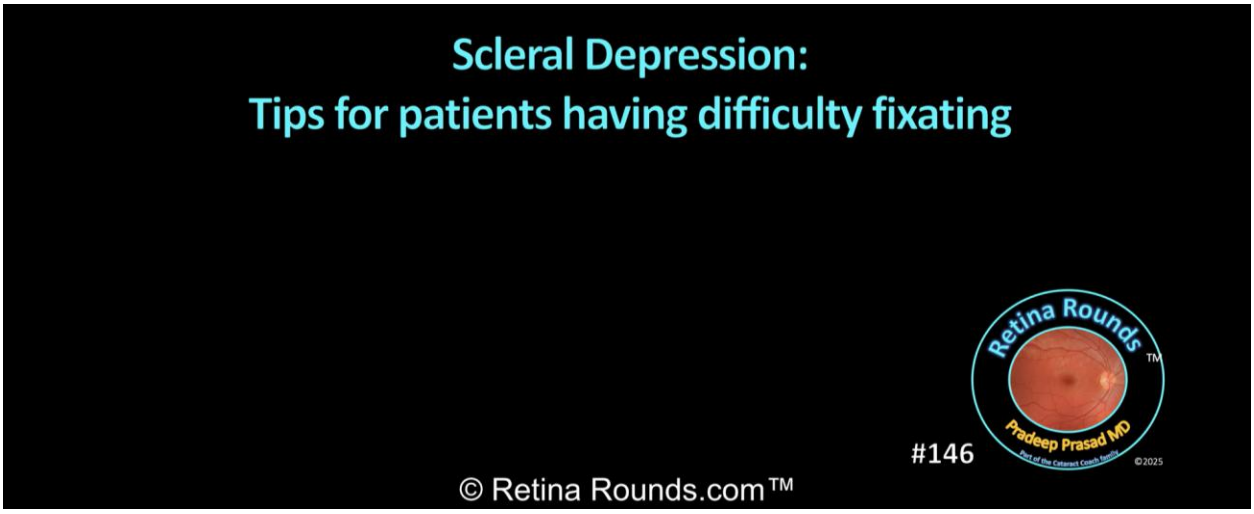
pressure. Patients find this far more comfortable. You'll find with practice that you don't need much pressure to get the needed view. Often, novice physicians push too hard to see the depression, and it's because they haven't lined up their view properly, which is a topic that we'll get to in a little bit. If you have everything lined up just right, you'll find that the amount of pressure that you need to apply is really not that much. For the surgeon, keep the chair height at a comfortable working distance. You don't want to hunch over the patient and potentially injure your back. Also, make sure that the patient is maximally reclined, ideally with their head pointing straight up to the ceiling. You want to make sure that your chair is positioned so that there's adequate room to navigate around the patient's head while examining the different quadrants of the eye.



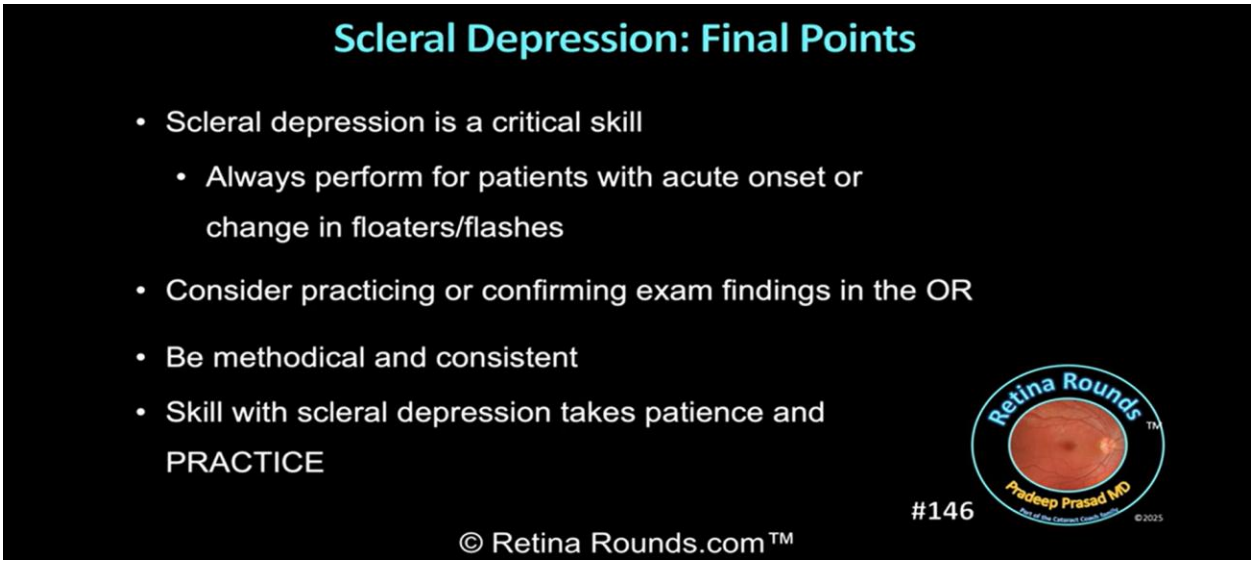
Now, probably the most important thing to take away from this overview of scleral depression is the importance of getting everything lined up. What do I mean by that? Well, the patient's gaze, your scleral depressor, and your eyes all have to be lined up in the same direction. Now, the first two parts are fairly straightforward. If you want to perform scleral depression, for example, in the superotemporal quadrant, you should position your depressor in the superotemporal quadrant and have the patient look in the same superotemporal direction. Where I often see trainee struggle is with the orientation of their eyes. If you draw a line between your two eyes, that line should be pointed in the same direction as your depressor and the patient's gaze.



So, the next topic is how to position the scleral depressor. Now you can place a scleral depressor over the eyelid or directly onto the globe. Now, some additional anesthetic is likely going to be necessary if you're placing the depressor on the globe. But for the vast majority of patients, I've performed scleral depression over the eyelids. And this next section shows you how you can position the depressor optimally and most comfortably for the patient. The steps are as follows. First, have the patient look opposite to where you intend to apply the scleral depressor. Then, you apply the scleral depressor and have the patient look in that same direction. As their eyes move, you'll find that the depressor rolls posteriorly in the eyelid crease and it is then ideally positioned to allow for visualization of the vitreous base.



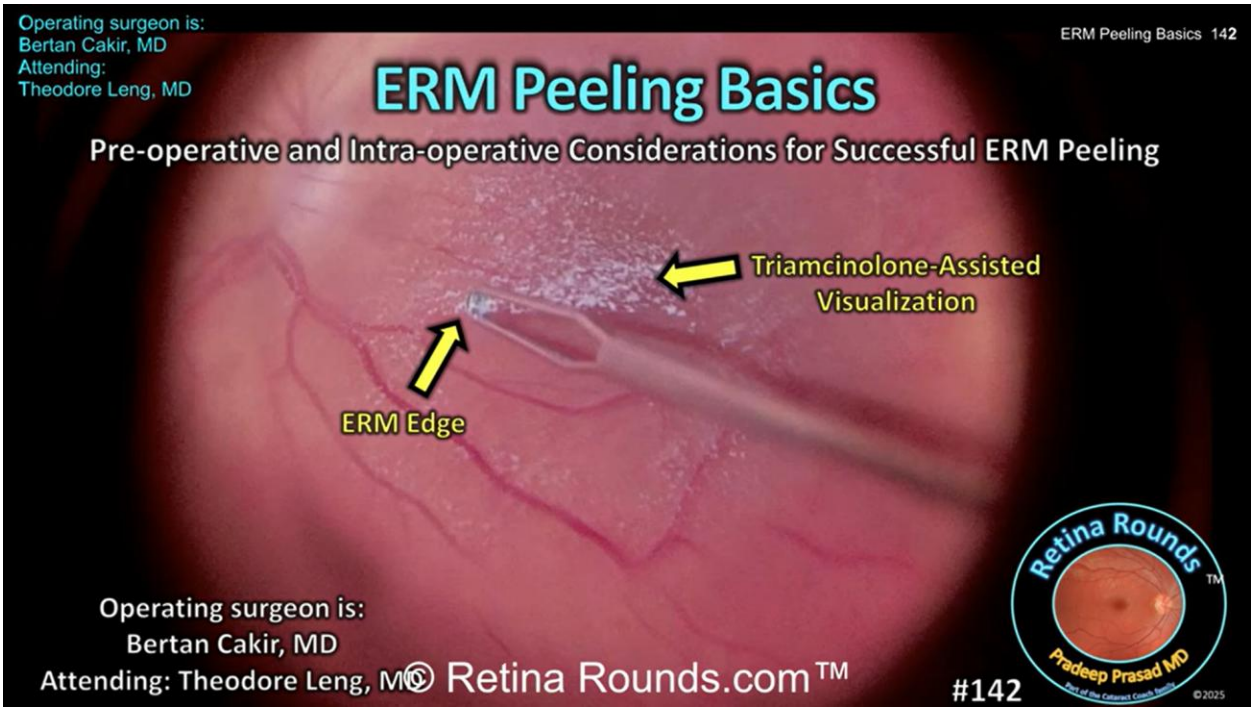
How about patients who are having a difficult time fixating. Now often this is going to be because the fellow eye is closed. So, you always want to encourage patients to keep both eyes open. And if they're having a difficult time, one useful strategy is to have them use their own finger as a target to look at. So, you can position their hand wherever you want, they can look at that finger and not only is the finger a target, but they also have some proprioception that's involved that's going to allow them to better look in different fields of gaze.



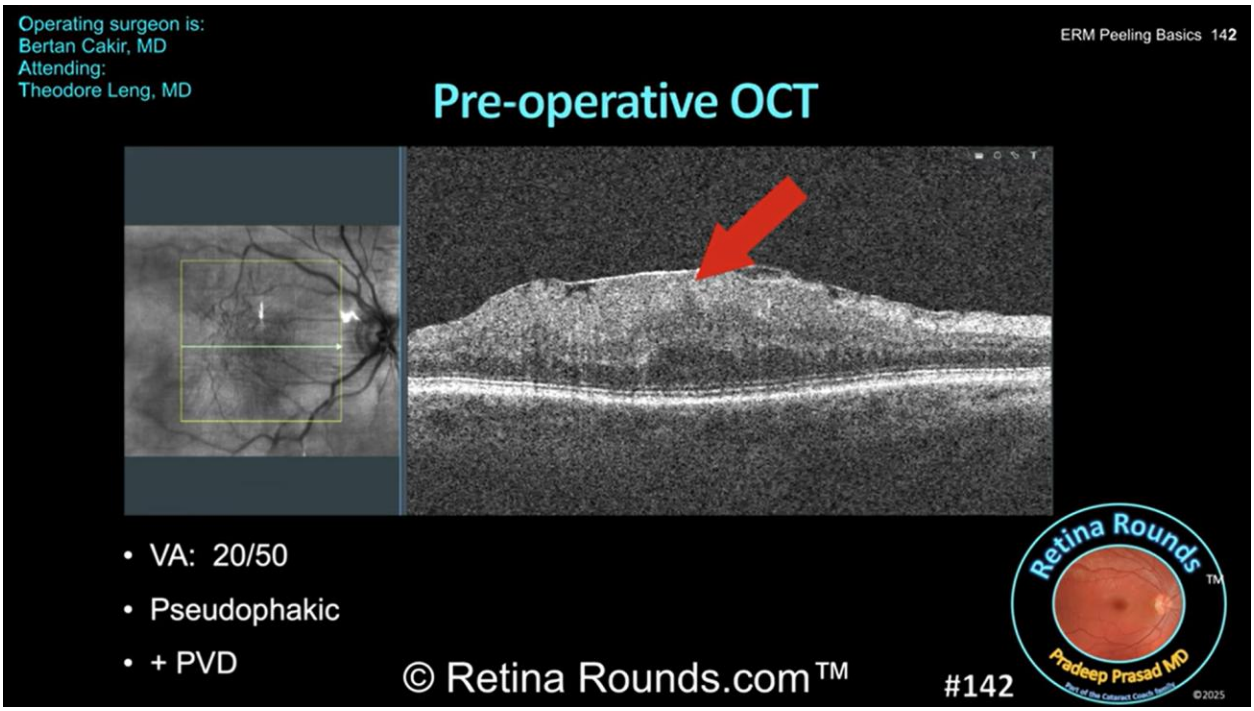
So, to wrap things up, scleral depression is a critical skill that all eyecare providers need to be comfortable performing. Remember this along with a three mirror contact lens are the only ways to view the retina up to the ora serrata. Now don't be fooled by obtaining a fundus photo or performing fundoscopy without scleral depression in patients with acute onset or sudden increase in floaters or flashes. Scleral depression is essential and if you don't feel comfortable performing this this exam, please refer the patient to a colleague who can. One of the best times to practice scleral depression and to confirm examination findings is to do it just before surgery for those patients who are undergoing general anesthesia. Just make sure that the cornea stays well lubricated while you're examining the patient. I highly recommend being methodical and consistent when performing scleral depression. Make sure to cover all quadrants of the eye and do it consistently so that you don't miss seeing peripheral pathology. And last, scleral depression takes a lot of practice. Look for opportunities to hone this examination skill and be patient. It takes many reps to get comfortable, but once you get good at scleral depression, you'll be doing your patients a great service.

- **ERM Peeling Basics**

Link: https://www.youtube.com/watch?v=cc8Dawxi_0A

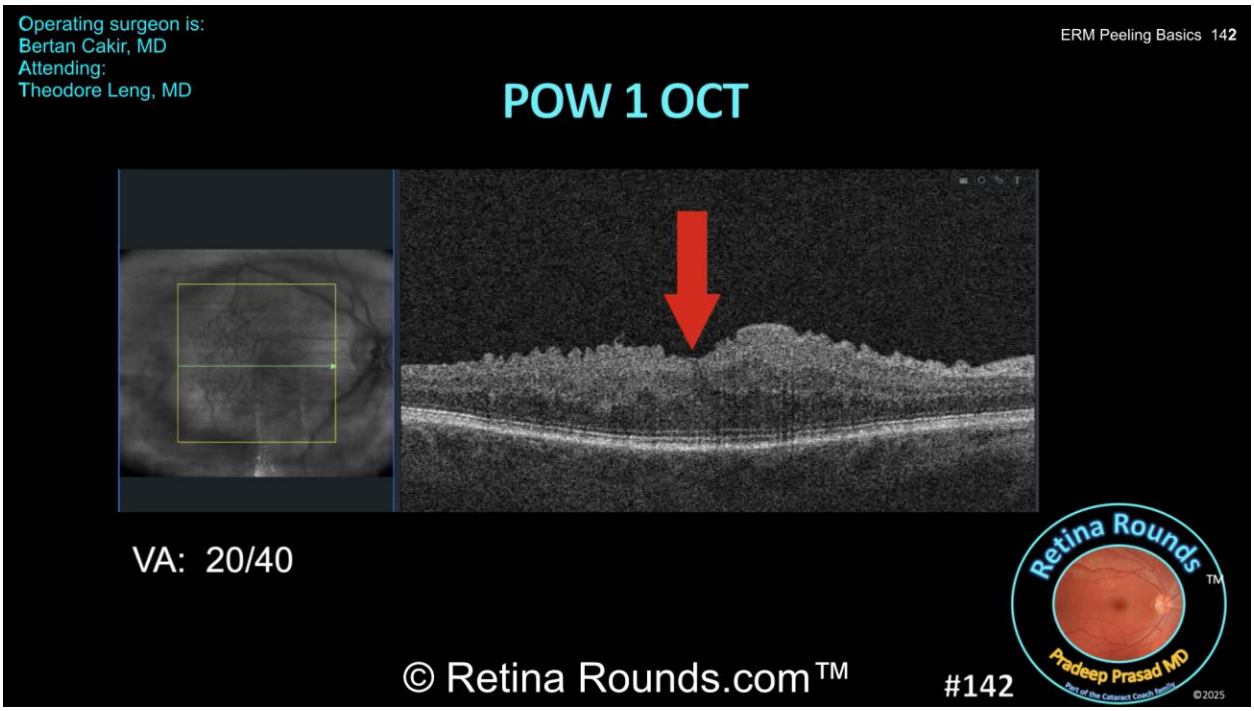


In this video we will discuss pre-operative and intra-operative considerations for epiretinal membrane peeling. The case is presented by Dr. Bertan Cakir who performed the surgery as a 1st year vitreoretinal fellow under the supervision of attending Dr. Theodore Leng. It nicely illustrates good fundamental techniques for ERM peeling. Be sure to stay tuned to the end of the video where we will look at OCT biomarkers for epiretinal membranes that can help you in surgical planning.

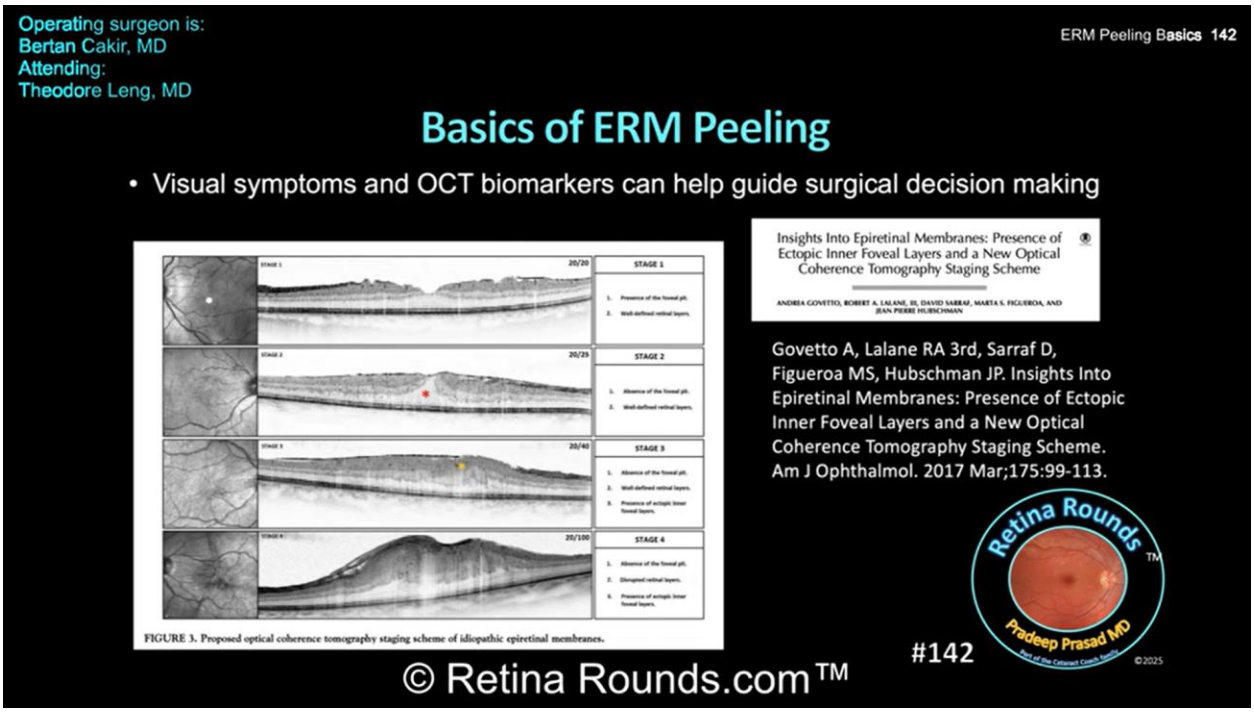


So, this is a 50-year-old pseudophakic patient with a PVD and an idiopathic epiretinal membrane. On the OCT, you can see the hyperreflective line on top of the macula, which represents the ERM. Two things I think are important to notice on this OCT. First, overlying the fovea, we see inner retinal layers that are extending over an elongated outer nuclear layer. This is highlighted by the red arrow. These are of course abnormal since we shouldn't see inner nuclear or inner plexiform layers overlying the outer nuclear layer at the fovea and this is termed ectopic inner foveal layers. The other finding is that there's disorganization of the inner layers of the retina most likely due to chronic tractional forces. So, these findings make this a stage 4 ERM which carries with it a higher likelihood of poor vision at baseline and possibly poor visual prognosis than lower stage ERM. Now at the end of the case we'll review in more detail the staging of ERM and other OCT biomarkers to be aware of.

The technique is explained in the video.

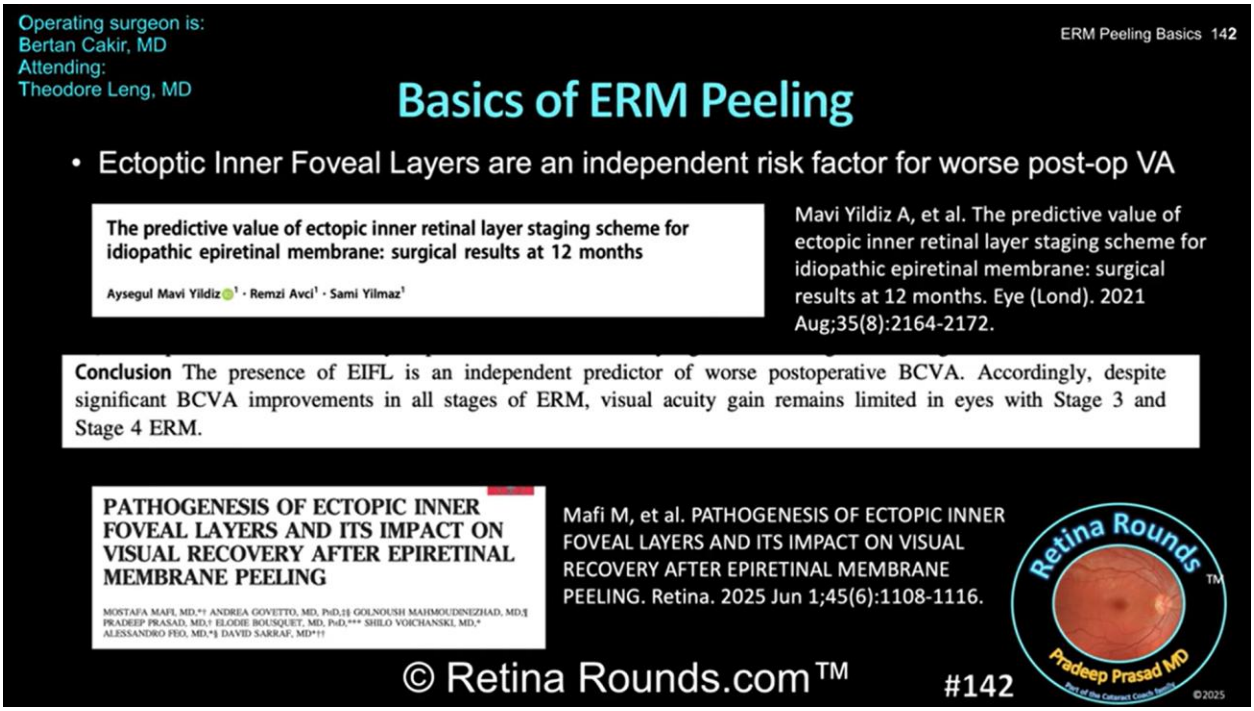


So, here's the patient at postoperative week 1 and you can see already a normalization of the foveal contour and resolution of the ectopic inner foveal layers. Now the foveal outer nuclear layer still looks to be elongated but it's early in this patient's post-operative course and there's certainly more opportunity for anatomic normalization in the coming months. Notably this patient's vision has already imp improved to 20/40 and the patient's metamorphopsia has improved as well.



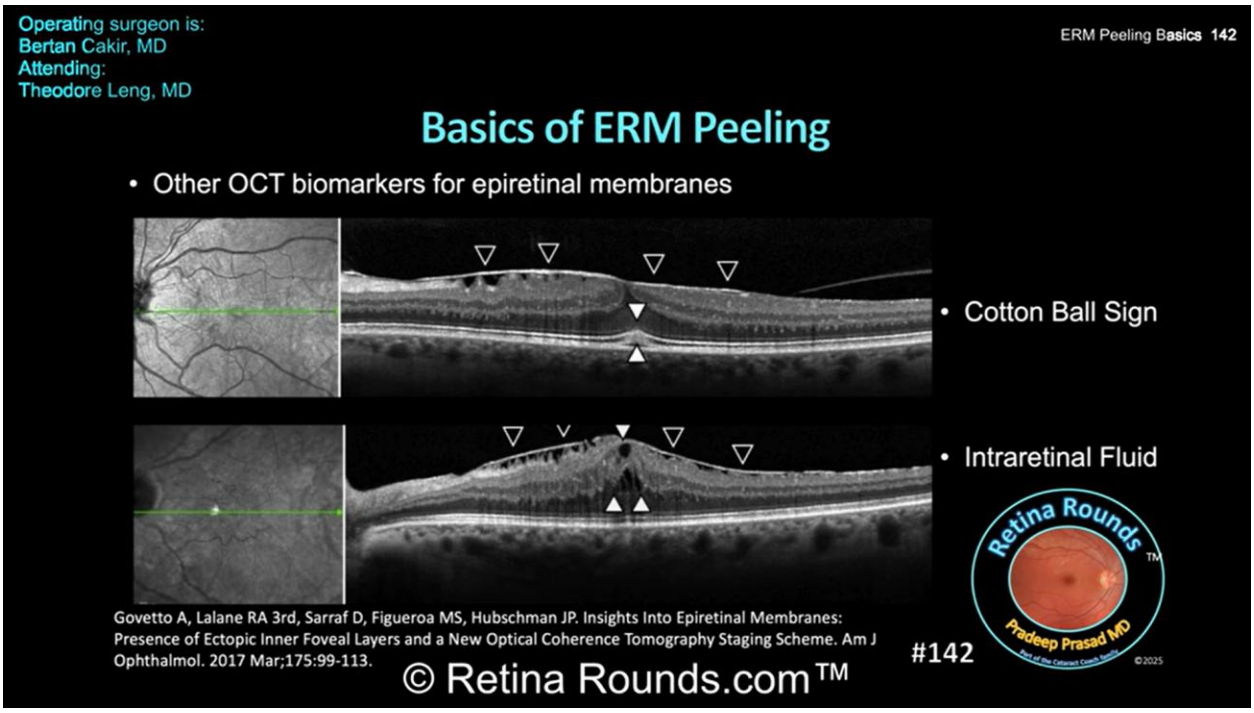
So, here are some points for discussion. The first is how we decide whether or not to operate on an epiretinal membrane and the surgeon should take into account multiple factors. Certainly the severity of visual symptoms including blurred vision and metamorphopsia need to be accounted for especially with respect to how much these symptoms are actually interfering with the patient's day-to-day life and also the patient's symptoms should be correlated with the degree of anatomic findings. If there is a disconnect between the anatomic findings on OCT or fundoscopy and the patient's symptoms, other causes of vision decline should be should be should be investigated. Now trend over time can also be helpful to determine the appropriate time to intervene surgically and that applies to OCT findings which can evolve over time.

In this article by Andrea Govetto and colleagues from the AJO in 2017, a new staging system for epiretinal membranes was presented and we'll go over that right now. A **stage one ERM** shown at the top demonstrates a normal foveal contour, normal inner and outer retinal layers and no ectopic layers over the phobia. What I mean by that is you can see that at the fovea, we see the outer nuclear layer without overlying inner layers like the inner nuclear layer or the inner plexiform layer. But, in later stage ERM, you can start seeing some of these ectopic layers growing over the fovea. Now, the next image below that is a **stage 2 ERM** where we see flattening of the foveal pit, but still well-defined retinal layers and no ectopic inner foveal layers. You can see elongation of the outer nuclear layer, which is highlighted here by the red star. The image below that is a **stage 3 ERM** which is where we can start to see ectopic interfoveal layers, but the retinal layers themselves are still well defined. You can see in this OCT uh we see that there are ectopic interfoveal layers overlying the fovea and those are highlighted by the yellow star. Now the bottom image is a **stage 4 ERM** where we now also see disorganization of the inner layers of the retina. This is very similar to the ERM that was presented in today's video.

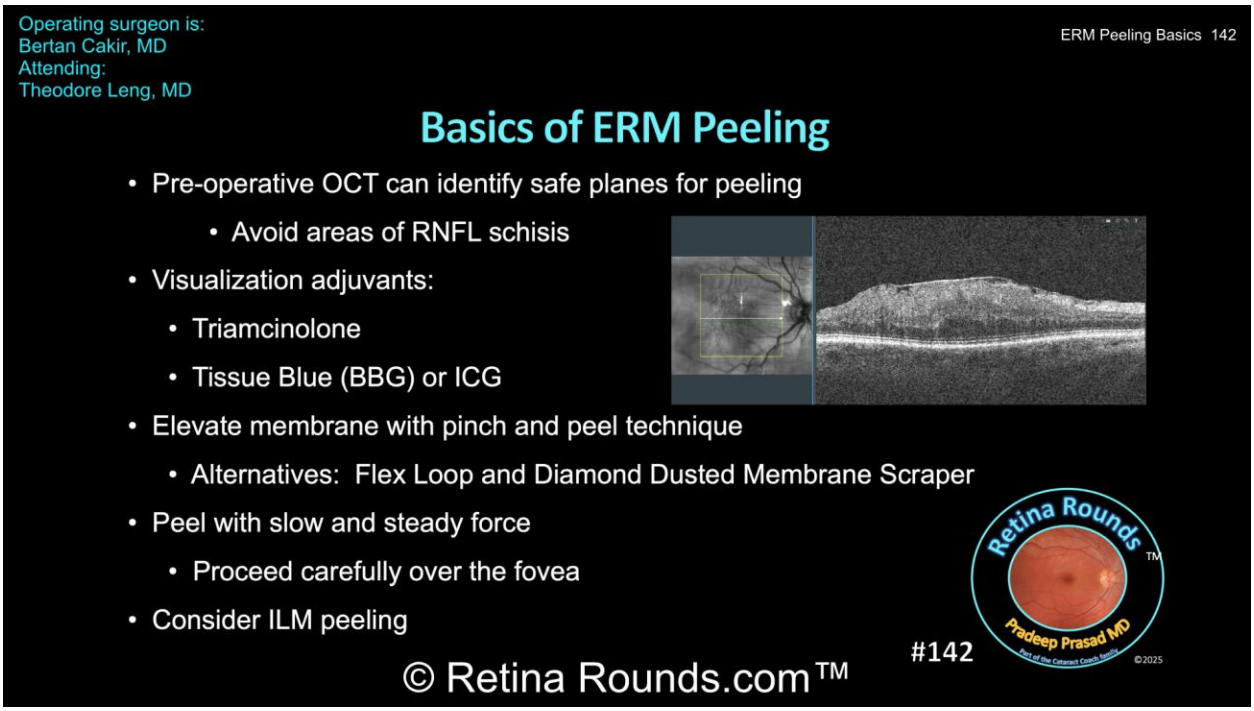


So why do we care about these OCT biomarkers? Well, the higher the stage of the ERM typically the worse the visual symptoms. But more important post-operative outcomes are not as

good with stage 3 and stage 4 ERM as was shown in this study by Dr. Aysegul Mavi Yildiz and colleagues which was published in Eye in 2021. Now while vision improvements can be seen in all stages of epiretinal membranes, the gains in stage 3 and stage stage 4 ERM are not as great and this might be an argument to either intervene at an earlier stage than stage three or to intervene once a patient begins to develop a stage 3 and stage 4 ERM. These findings were corroborated in our study by lead author Mustafa Mafi who also found that improvement in ectopic interfoveal layer thickness correlates with better visual outcomes. A good sign actually when we're looking at the early post-operative OCT for the patient presented in today's video.



Some other biomarkers to look out for include the cotton ball sign which is a hyperreflective focus that can be seen in the outer retina at the fovea and that's shown in the upper image here as well as intraretinal fluid which is shown in the bottom image and both of these can be associated with worse visual symptoms and may be markers that one can use to decide whether or not to intervene for an epiretinal membrane.



The OCT can be helpful for surgical planning. Elevations in the ERM and OCT can help the surgeon to identify a safe spot to initiate the ERM peeling. It's also worth noting that areas of RNFL schisis should generally be avoided for initiating a peel because that can further exacerbate damage to the nerve fiber layer. Now there are a number of adjuvants that can be used to aid in visualization of epiretinal membranes during peeling. In this case, Dr. Cakir showed us the use of dilute triamcinolone which isn't exactly a stain but the settling of the crystals on the ERM and on the macular surface can aid in depth perception and can aid in identifying areas where the ERM has been peeled and conversely where the ERM is still present. Now tissue blue or ICG can also be used although these dies stain the ILM and therefore provide a negative stain for the ERM that is of course superficial to the ILM.

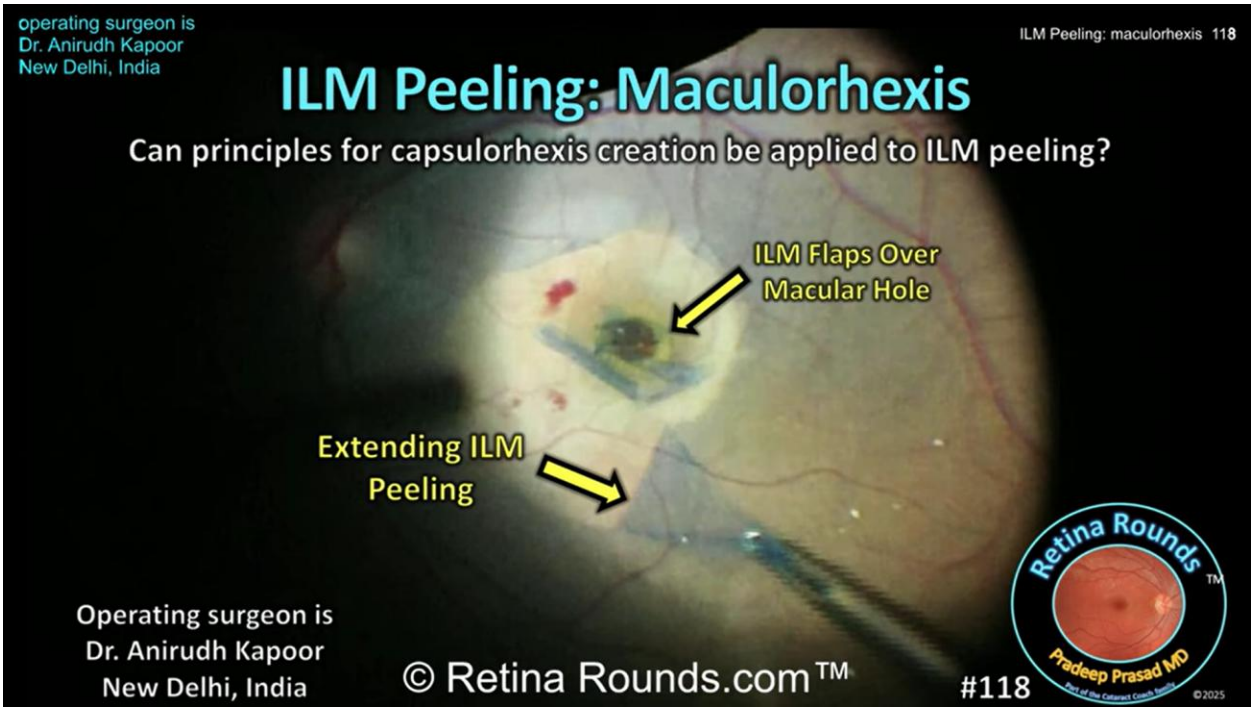
Now when elevating membranes, Dr. Cakir showed us the pinch and peel technique whereby the ERM is grasped with ILM forceps perpendicular to the retinal surface. Ideally during the first pinch, the tissue should be gently elevated and rocked laterally to loosen the ERM from its underlying adhesions. Then that loosened ERM can be regrasped and peeled in a way that is tangential to the edge of the ERM, and that peeling can be extended circumferentially. Now, some ERMs can be tightly adherent and some surgeons prefer the use of a flex loop or a diamond dusted membrane scraper to initiate the ERM peeling, which we showed you in episode 115.

Now, when extending the peel, it's important to go slowly and use steady force, carefully looking out for excess traction on the inner retina and ensuring that the movement of the forceps doesn't inadvertently make contact with the inner retina. Once the peeling is done, some surgeons also prefer to stain and peel the ILM. While studies have shown that visual outcomes are not different with ILM peeling, this extra step can decrease the risk of recurrent ERM formation. And so, the surgeon will have to decide the risk benefit of performing this additional step.

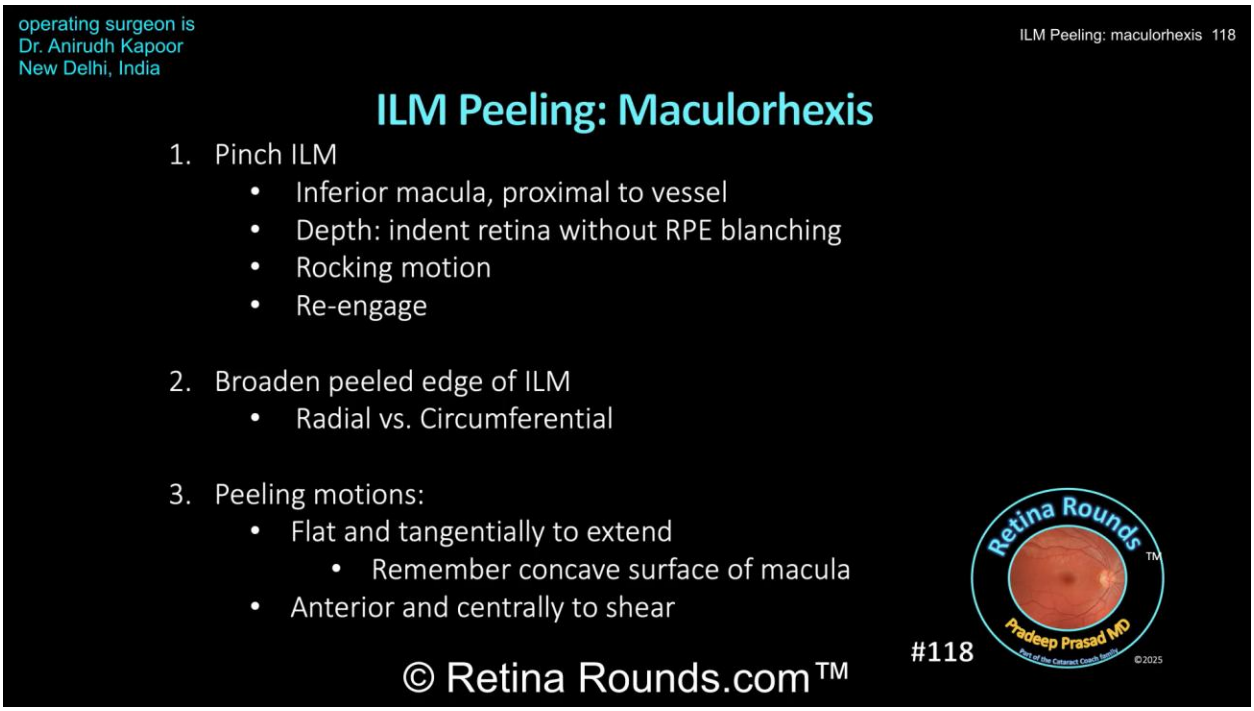
Overall, the steps of ERM peeling were beautifully demonstrated by Dr. Cakir in this case. We want to thank him for sharing this case and for giving us all an opportunity to learn more about ERM management. Thanks for watching.

- **ILM Peeling: Maculorhexis**

Link: https://www.youtube.com/watch?v=ywfRSRTzzUo



ILM peeling, in some ways, is similar to creating a capsulorhexis. Both ILM peeling and capsulorhexis creation involve peeling a circular area of very thin tissue, although the surfaces are different: the lens is convex and the macula is concave. However, the mechanics and best practices of capsulorhexis creation can be applied for successful ILM peeling. This is nicely demonstrated by our guest surgeon Dr. Anirudh Kapoor who is a graduating vitreoretinal, cataract and refractive surgery senior resident at the world renowned All India Institute of Medical Sciences in New Delhi, India. We want to thank Dr. Kapoor for sharing this case!



So, let's break down the ILM peeling. Here we're going to specifically talk about the pinch and peel technique. Now there are other ways of fracturing and peeling the ILM such as with the use of a flex loop which we'll show you in another episode.

In the pinch and peel technique, first you have to consider where you're going to fracture the ILM. Now typically this is going to be recommended in the inferior macula since it's usually an ergonomically easy area to access and any scotomas will be in the superior visual field which tends to be less bothersome than the inferior visual field. We also prefer pinching proximal to but not involving a blood vessel since the ILM is a bit easier to fracture in this location.

Now the maneuver is this. First you place the open ILM forceps on top of the desired area of retina and then you gently indent those forceps and you want to just barely indent the inner surface of the retina. If you see any blanching of the of the RPE, your forceps are too deep. Once that retina has been barely indented, you want to close the forceps to engage the ILM. Now here the most common mistake I see fellows make is that as they're pinching, they are pulling the forceps up away from the macula. So, when they close the forceps, there's nothing that's been engaged. So, you want to make a conscious effort not to move the forceps in an anteroposterior direction when pinching the ILM. So, once you've pinched, you want to gently rock back and forth to loosen the ILM from the underlying retina. Next, you want to release what you've pinched and then re-engage just that loosened bit of ILM, pulling along the surface of the macula to fracture the ILM. With a good stain, the edge of the fractured ILM should be well visualized.

Next you have to extend the ILM peel and, in this case Dr. Kapoor extended the peeling circumferentially at first to define the width of that inferior inverted ILM flap and another option is to pull directly towards the fovea to create a radial extension of the flap and this is really up to the surgeon's preference.

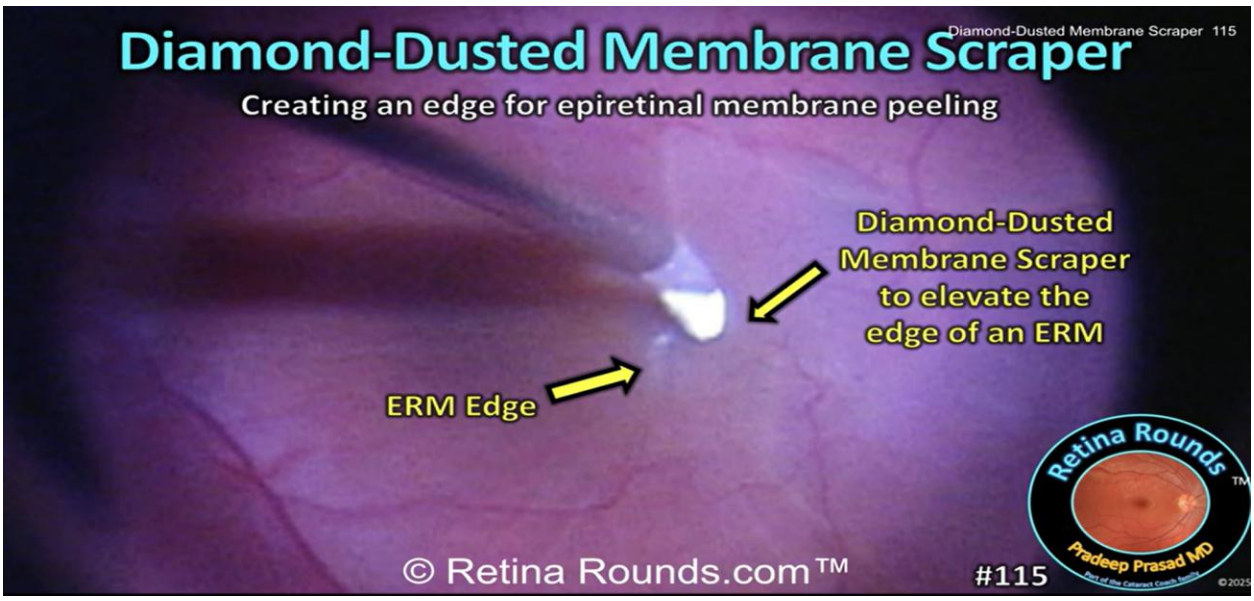
Once that broader edge of the ILM has been defined, the next step is to extend the peeling of the ILM. There are basically two movements. To propagate a broader ILM peel, it's best to peel in a circumferential motion with the leading edge of the flap close to the macula. So, your forceps should be just moving over the surface of the macula. You want to lead that edge of the flap by pulling in the desired direction. You can feel free to regrasp that flap close to the base of the flap for the best control. This is similar to how you would regrasp a capsulorhexis edge at the base of that capsulorhexis flap. The movement of staying close to the surface of the lens is similar to staying close to the surface of the macula to have the best control over the direction and the size of the peel. However, there is one important difference. Unlike creating a capsulorhexis, you have to remember that the macula is relatively concave. So, you have to be careful that the forceps as you're moving over the surface of the macula, you don't touch or rub into the surface of the macula as the ILM peeling is being performed so that the tip of your ILM forceps along with the entire flap needs to be visualized at all times.

In some cases, you may want to do a broad single peel but in other cases you may want to do smaller peels to create. For example, ILM flaps as was done by Dr. Kapoor in this case. Now to create a small flap the ILM peel should be pulled in an anterior direction towards the fovea. What's that's going to do is to shear the ILM so that you can create a smaller flap. Again, that would be something that typically would be done either at the termination of the ILM peeling for a broader flap or if you want to create smaller flaps for an inverted ILM peeling approach.

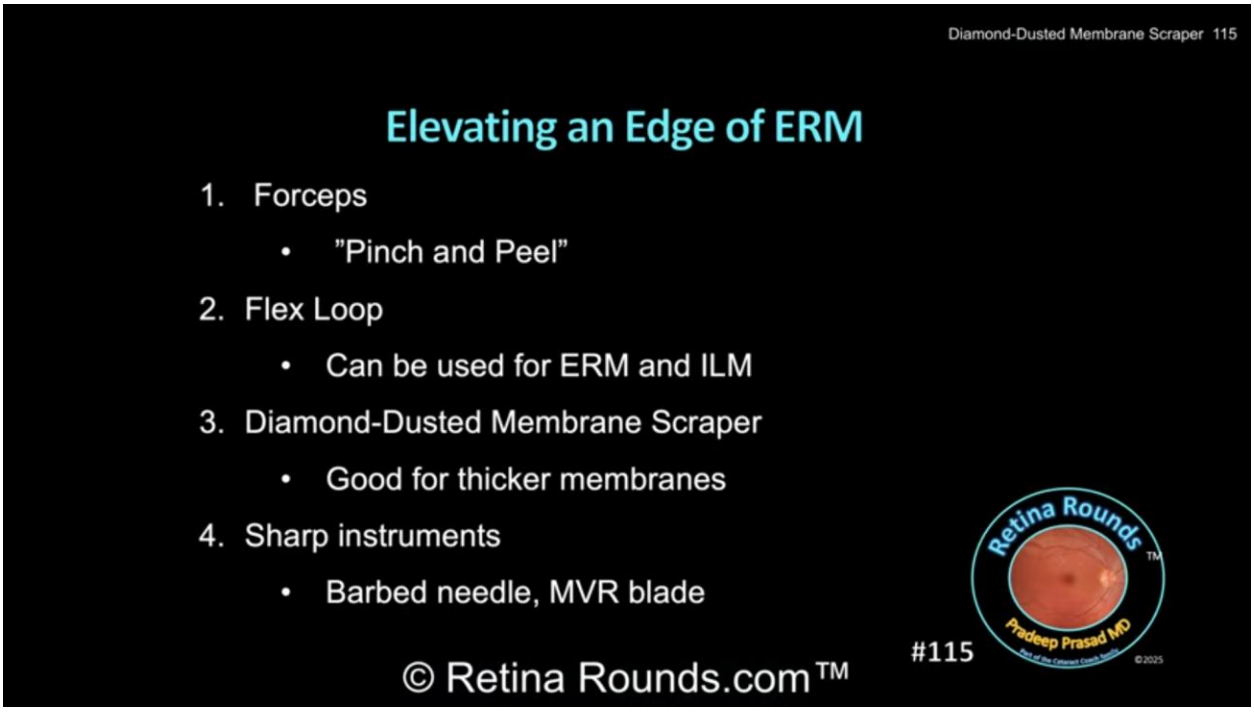
The extent or size of the overall IM peeling is going to be to the surgeon and the clinical scenario. But broader peeling is generally preferred in larger macular holes and in some cases in more myopic eyes. We want to thank Dr. Kapoor for sharing this case. This is really a very impressive surgery to be performed by a resident and we'll definitely be looking forward to more from him in the future. Thanks so much for watching.

- **Diamond-Dusted Membrane Scraper**

Link: https://www.youtube.com/watch?v=KW1tfbqyED8



When performing epiretinal membrane peeling, the first step is to elevate an edge of the ERM. Once an edge has been elevated, it can then be grasped to extend the membrane peel. There are a variety of techniques for creating this edge including the use of forceps ("pinch and peel" technique), Flex Loop, and sharp instruments like a barbed needle. In today's video we will show you the use of a Tano Diamond-Dusted Membrane Scraper. At the end of the video we will discuss some of options for ERM edge elevation and the clinical scenarios where one instrument may be preferred over another.



There are a number of ways to fracture and elevate an edge of ERM. We will show you examples of these different techniques in future videos.

I find that simply using the forceps to pinch and elevate an edge of ERM works for the vast majority of cases. In this so-called pinch and peel technique, grasping forceps are used to gently peel an edge of the ERM or gently engage an edge of the ERM then using a rocking motion once that ERM has been pinched that can loosen the ERM from the underlying adhesions to the retina. I like to then release and re-engage that elevated ERM with forceps to fracture an edge. Then that fractured edge can be grasped, and with the forceps, the membrane peeling can be extended.

An alternative to using forceps is to use a flex loop which is a nickel titanium extendable loop that has very small micro serrations in it. The flex loop can be used to gently elevate an edge of ERM. It's good not only for elevating an edge of ERM but also can be used to elevate an edge of ILM.

In today's video, we showed you the Tano Diamond Dusted Membrane Scraper. This instrument can be helpful for thicker or more tightly adherent membranes. It isn't quite as gentle as the flex loop, though, and it has to be used with caution. If too much pressure is applied to the retinal surface, it is possible for the diamond dusted membrane scraper to damage the inner

retina or to even create retinal breaks. However, for thicker membranes, a more robust tool like the diamond dusted scraper can allow for more efficient elevation of an ERM.

Last, for very tightly adherent membrane, sometimes sharp instruments are needed to incise the membrane and sharply dissect between the plane of the membrane and the underlying retina. For this, a barbed needle works quite well. By rubbing the edge of a needle against a flat surface, a small barb is created and that can be used to perform a very precise sharp incision and dissection. Alternatively, for broader and thicker membranes, a barbed or bent MVR blade can also be used. Now, the bottom line here is that there are many ways to elevate an edge of ERM and the anatomic characteristics of the ERM and underlying retina can help you to decide which instruments to use. As always, it's important to be exposed to and to try many techniques to perform the same task, and that can give the surgeon some flexibility and options based on the particular clinical scenario. Thanks for watching.

- **10 Steps for Diabetic TRD Repair**

Link: https://www.youtube.com/watch?v=T4G7mwYbAfI

While there is no cookbook-style recipe for diabetic TRD repair, there are a number of general principles that should be followed. Here, guest surgeon Dr. David Perez Gonzalez, beautifully demonstrates a complete case of TRD repair and highlights 10 key steps that can be applied to most diabetic TRD cases. Remember that these steps are not necessarily in order and do not encompass every technique for TRD repair. Surgical management of TRD's requires flexibility to address surgical challenges as they arise. However, I hope that you will find this general overview to be a valuable

framework upon which we will do a deeper dive in future videos for specific techniques of diabetic TRD repair. Thank you again Dr. Gonzalez for sharing this case!

Here is just a review of those 10 steps that we just covered:

First you want to perform a core vitrectomy just as you would with any type of vitrectomy case and then you want to segment the anterior and posterior cortical vitreous 360° so that any manipulation or any dissection that you're doing in the posterior segment doesn't translate into traction at the vitreoretinal base.

Bleeding will arise at multiple times throughout the surgery and it's important to address it as it arises using diathermy to cauterize any oozing blood vessels or tamponade pressure. Although I like to use tamponade pressure sparingly given that these eyes are already quite ischemic, we don't want to further exacerbate any ischemic damage to the retinal tissue.

Once the segmentation of the anterior and posterior cortical vitreous has been done, you want to get into the right plane before dissecting any membranes. If you're not in the right plane, you'll be wasting a lot of time and expending a lot of effort and you'll often have to redo that work if you're not dissecting in the right plane. So that can be identified in a variety of ways. In this particular case, the forceps were used to sort of elevate the vitreous over the macula and that created enough space for the segmentation to follow. Lifting the hyaloid over the optic nerve is usually a very reliable way of making sure that you're in the right plane; however, it does raise the risk of potential bleeding over the optic nerve which can be in some cases difficult to control. So once you're in the right plane, and by the right plane I mean you should be within or between the cortical vitreous, the retina segmentation can then follow and that involves using the cutter following the plane itself not lifting up too much on the vitreous because you don't want to exert traction in those pegs or trunks where the neovascular fronds are emanating from the retina but

you want to just follow the course of the retina and follow that plane so that you can isolate the pegs before delaminating and that takes us to our next step.

Once the segmentation has been done, you really want to make sure that you've segmented the vitreous thoroughly all around the pegs before delaminating which will help to decrease the risk of iatrogenic breaks especially when using the cutter to delaminate the pegs.

Finally, you want to finish the peripheral vitrectomy. Identify any residual vitreous with dilute triamcinolone, and staining with triamcinolone is really important in these cases because diabetic vitreous tends to be schisic, there could be multiple layers and while you might think that you're in the right plane or that all the cortical vitreous is up, sometimes there can be some residual cortical vitreous that can be identified with the use of triamcinolone.

Once that's all done, you can perform your panretinal photocoagulation. Remember not to forget the anterior retina either with the aid of scleral depression, or later on in the case under air, you can get to that anterior retina to complete the PRP.

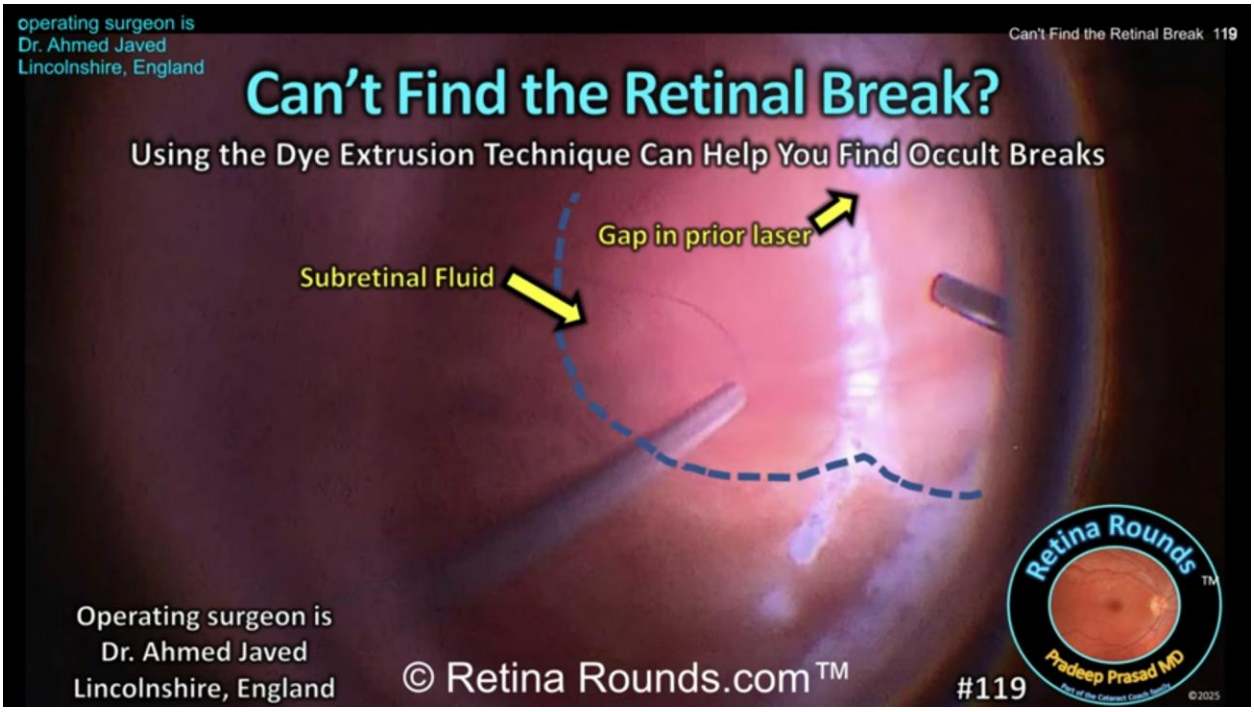
Then I like to do an air fluid exchange at the end of the surgery to remove any residual vitreous hemorrhage. Also, with the air in the eye, think that if there are any oozing blood vessels, a clot will form over those oozing blood vessels and hopefully minimize the degree of post-operative vitreous hemorrhage.

One last step that I like to do just to confirm that I've got good hemostasis is to go ahead and drop the intraocular pressure to about 10 mmHg. Usually, we're operating at 25 mm of mercury mmHg which is higher than the pressure will be in the immediate and later postoperative period. So, I like to do a little bit of a stress test by lowering the intraocular pressure to about 10 mmHg to look for any oozing blood vessels then go ahead and do the air fluid exchange.

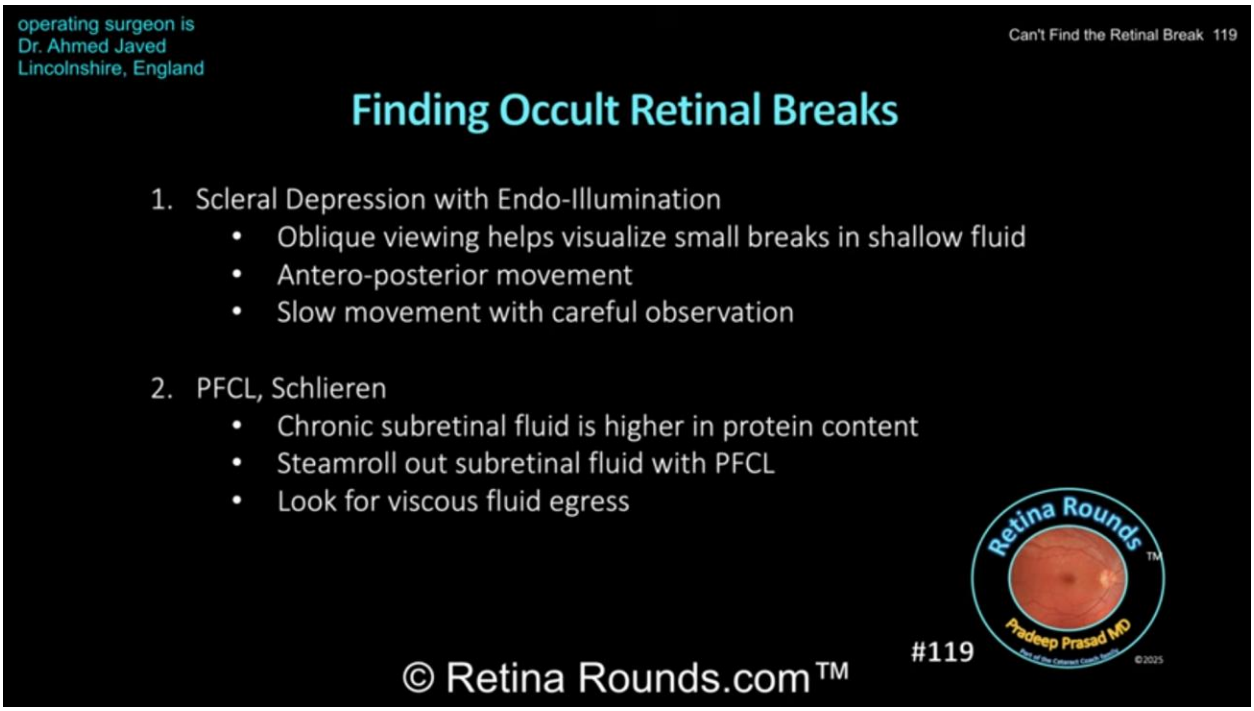
This is a very beautifully done case that shown at a fast speed so that we could get through the entire case but really a beautiful job done by Dr Gonzalez demonstrating all the different principles, all the different techniques for successfully treating diabetic tractional detachment so thank him. I want to thank him very much for sharing this case.

- **Can't Find the Retinal Break?**

Link: https://www.youtube.com/watch?v=Kw2VEPXbVh4



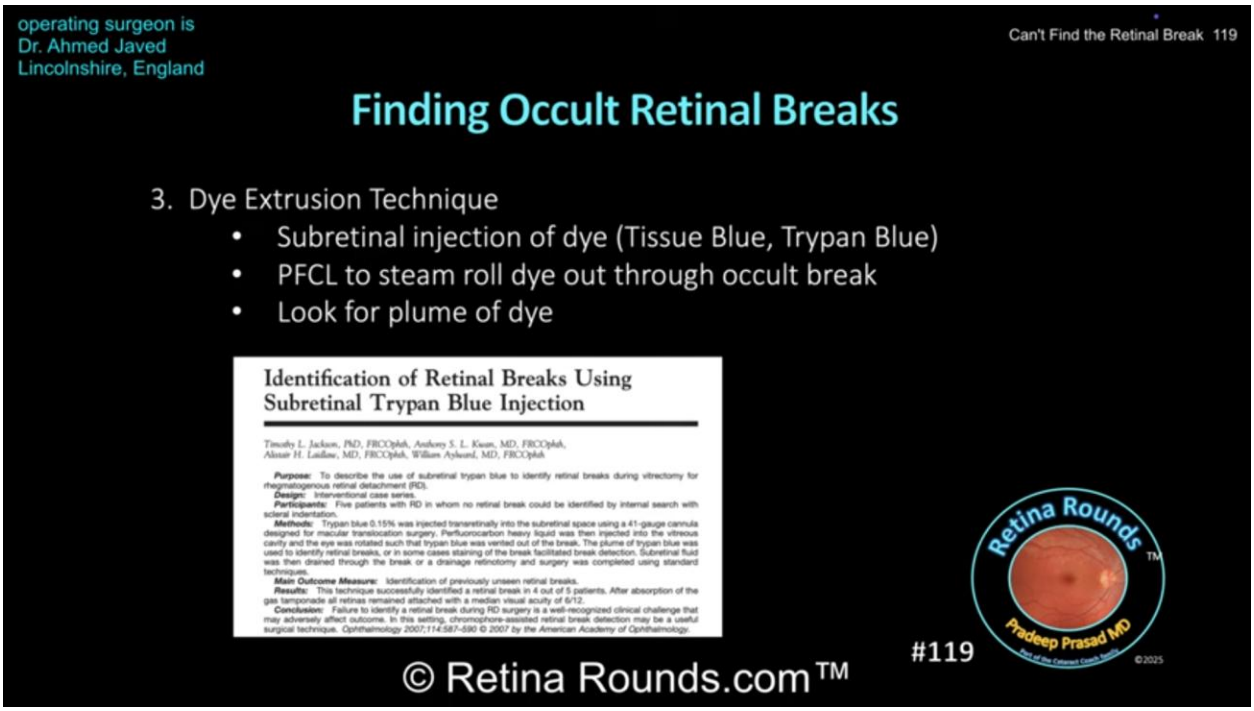
Sometimes, even with a careful scleral depressed examination in the clinic, the causative retinal break in rhegmatogenous retinal detachments cannot be identified. Serous or exudative retinal detachments need to be ruled out, but if the surgeon is convinced that the detachment is rhegmatogenous in nature, sometimes intraoperative identification of breaks may be necessary. In today's case, presented by guest surgeon Dr. Ahmed Javed from Lincolnshire, England, intraoperative scleral depression failed to reveal the break. In this scenario, Dr. Javed employs the dye extrusion technique to identify an occult retinal break. It's an elegant approach and at the end of the case we will discuss some tips for finding occult retinal breaks. Thank you, Dr. Javed, for sharing this case and for more videos from Dr. Javed, please visit his YouTube site.



So here are some take-home points.

Now when trying to find an occult retinal break, your first move should be to perform a careful scleral depress examination with endolumination. Now this is of course assuming that one has already attempted to perform a careful scleral depression examination either in the clinic or right before surgery when the patient is sedated and a more detailed examination can be performed. But if a retinal break could not be identified intraoperative scleral depression with endolumination is your next move. Small retinal breaks especially when the subretinal fluid is shallow and or if the fundus is blonde can be very difficult to visualize and scleral depression gives the surgeon an oblique viewing angle that can make visualization of these breaks a little bit more apparent. Now generally the movement of the depressor should be in an anteroposterior fashion again with slow movements and careful observation to try to find very small retinal breaks.

Now if this fails, another option is to put down perfluorocarbon liquid steamrolling out the subretinal fluid and making use of the Schlieren technique. Chronic subretinal fluid tends to be higher in protein content and has a greater density than BSS and the difference in the refractive index of the subretinal fluid can be used to allow it to be visualized as it egresses from the retinal break. This is the basis of the Schlieren optical technique.



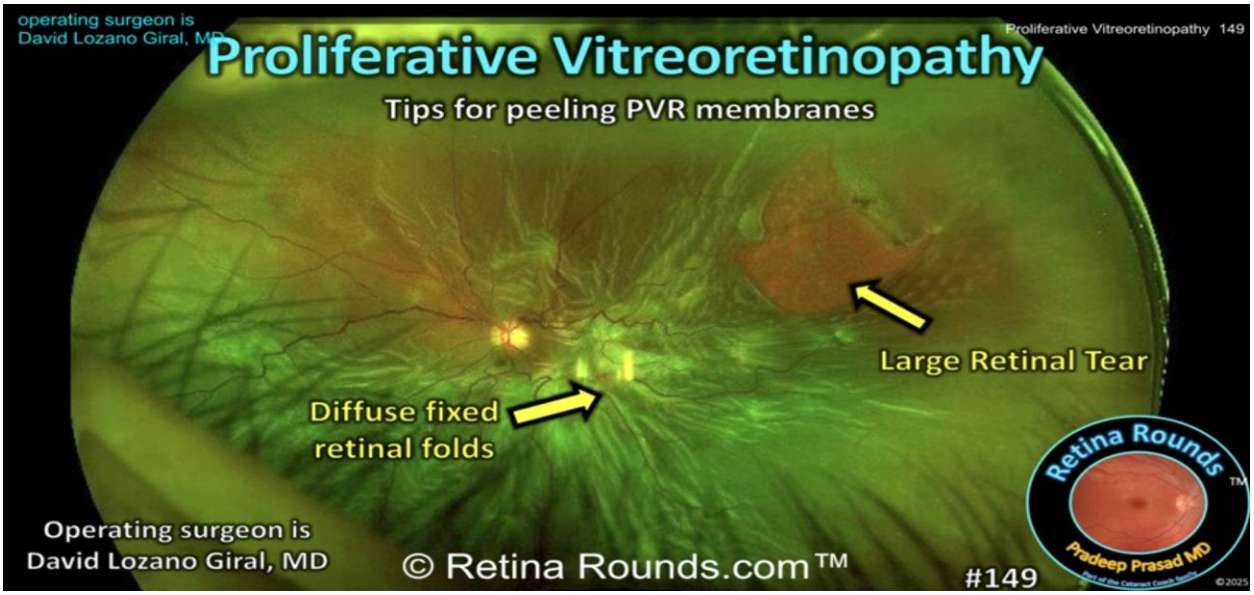
Now for non-dense subretinal fluid or if the detachment is very shallow, this can still be challenging to visualize the fluid as it egresses. And so, the next uh option if that fails is to try with the dye extrusion technique and that's the technique that was employed by Dr. Javeed. So here a vital dye is injected into the subretinal space. In this case, it was done with a 41-gauge subretinal canula using a tissue blue or brilliant blue dye. The technique was first described by Dr. Jackson and colleagues using trypan blue which of course is another option. As PFCL is used to steamroll the retina flat, one should look for a plume of the dye that egresses from the retinal break. Now once the break has been identified, it can then be marked with diathermy and then the PFCL can typically be used to completely flatten the retina and then laser can be applied around the retinal break.

One has to be careful for potentially missing retinal breaks especially if there are multiple breaks present and they may have variable degrees of allowing subretinal fluid to egresses as well as a potential for any toxicity that's associated with subretinal injection of these dyes. However, overall this is a very elegant technique and can be used in specific circumstances to find occult retinal breaks and we want to thank Dr. Javed for sharing this case with us and thanks so much for watching.

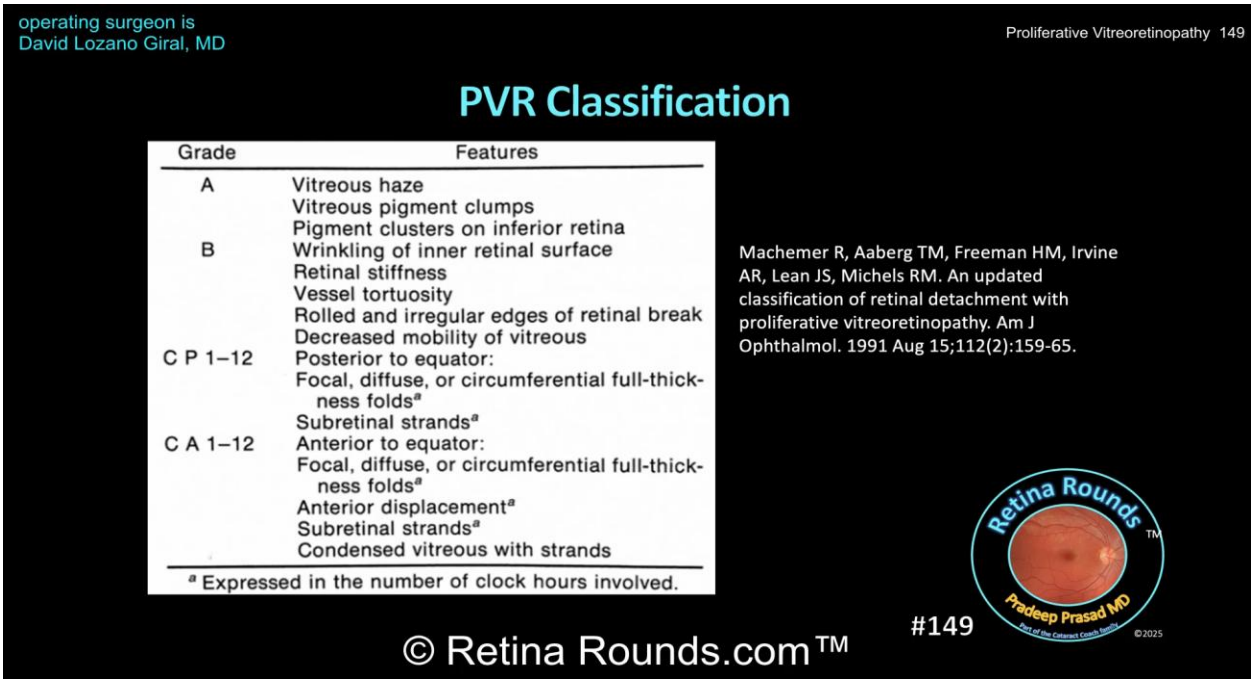
- **Proliferative Vitreoretinopathy**

Link: https://www.youtube.com/watch?v=DwXfi3Jjr8I

Please see the surgical video using the link above.

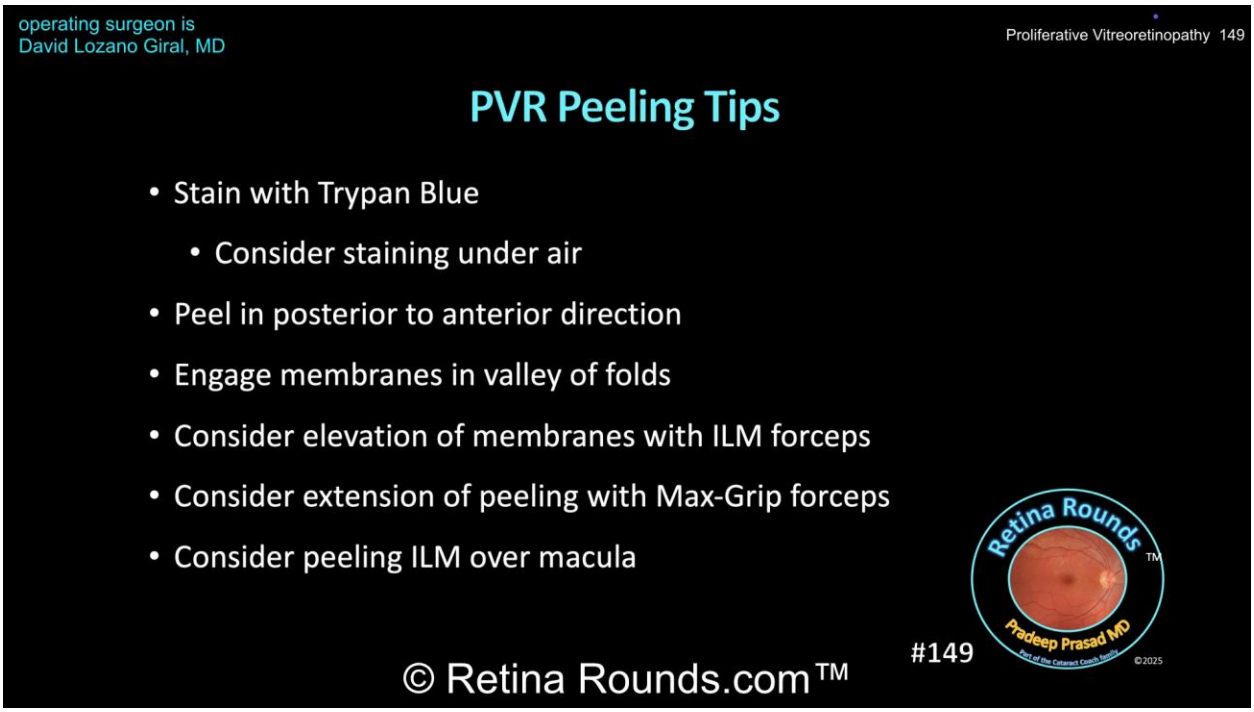


Today we will discuss tips for peeling PVR membranes in PVR-associated retinal detachments. While primary retinal detachment repair typically has a high success rate (85-90+% success rate), primary retinal detachment repair in eyes with PVR has a lower success rate, closer to 70%. Although pharmacologic adjuvants, such as methotrexate, hold promise for decreasing the risk of PVR-associated retinal re-detachment, good technique and thorough peeling of PVR membranes during primary retinal detachment repair are critical to achieve good anatomic outcomes. Today's case is presented by guest surgeon of the week, Dr. David Lozano Giral, who performed this surgery as a fellow at the Universidad Nacional Autonoma de Mexico in Mexico City. Dr. Lozano Giral is Assistant Professor of Ophthalmology at UCLA where he also serves as Director of the Ocular Trauma Service. This is a challenging case with a very nice post-operative outcome. We want to thank Dr. Lozano Giral for sharing this case!



Let's spend some time talking a bit about PVR classification. This is the retina society revised classification of PVR from 1991 which was published in the AJO by Dr. Machemer and colleagues. The lowest grade PVR grade A includes vitreous haze and pigment clumps or clusters either in the vitreous cavity or \ on the inferior retina. Grade B includes wrinkling of the inner retina with retinal stiffness, vascular tortuosity, rolled or irregular edges of the retinal break, and decreased vitreous mobility. Grade C includes full thickness retinal folds and/or subretinal bands and is split into grade CP if these findings are posterior to the equator or grade CA if the findings extend anterior to the equator. Now, grade CA may also include anterior displacement of the retina. Grades CP and CA are further categorized based on the number of clock hours involved.

Dr. Lozano's case is a grade CP5 since the PBR membranes were largely posterior and involved 5:00 hours from roughly the 1:00 to 6:00 clock hour positions.



Now, here are some tips for peeling PVR membranes.

First, visualization of PVR membranes is best achieved with trypan blue staining as was demonstrated in Dr. Lozano's case. One can also consider going under air and dripping trypan blue over the PVR membranes or over the retinal surface to get a more intense stain.

Now generally you want to peel in a posterior to anterior direction since the retina is more robust posteriorly. If the retina is completely detached, the optic nerve can serve as a source of counteraction. Counteraction can also be achieved with the light pipe or these membranes can be dissected using a bimanual approach.

Perfluorocarbon liquid is used by some surgeons to stabilize the posterior pole. But this does risk subretinal migration when tractional membranes have not yet been removed, especially in a case with a large posterior extending retinal break as we saw in this case.

Identifying and engaging membranes can sometimes be achieved by dragging open forceps gently over the retinal surface in the valleys of the folds. Either ILM or Max-Grip style forceps can be used. Although elevating the membranes with ILM forceps may be safer to avoid iatrogenic retinal breaks while the Max-Grip style forceps with that broad flat surface can better grasp these elevated membranes and facilitate stripping from the retinal surface.

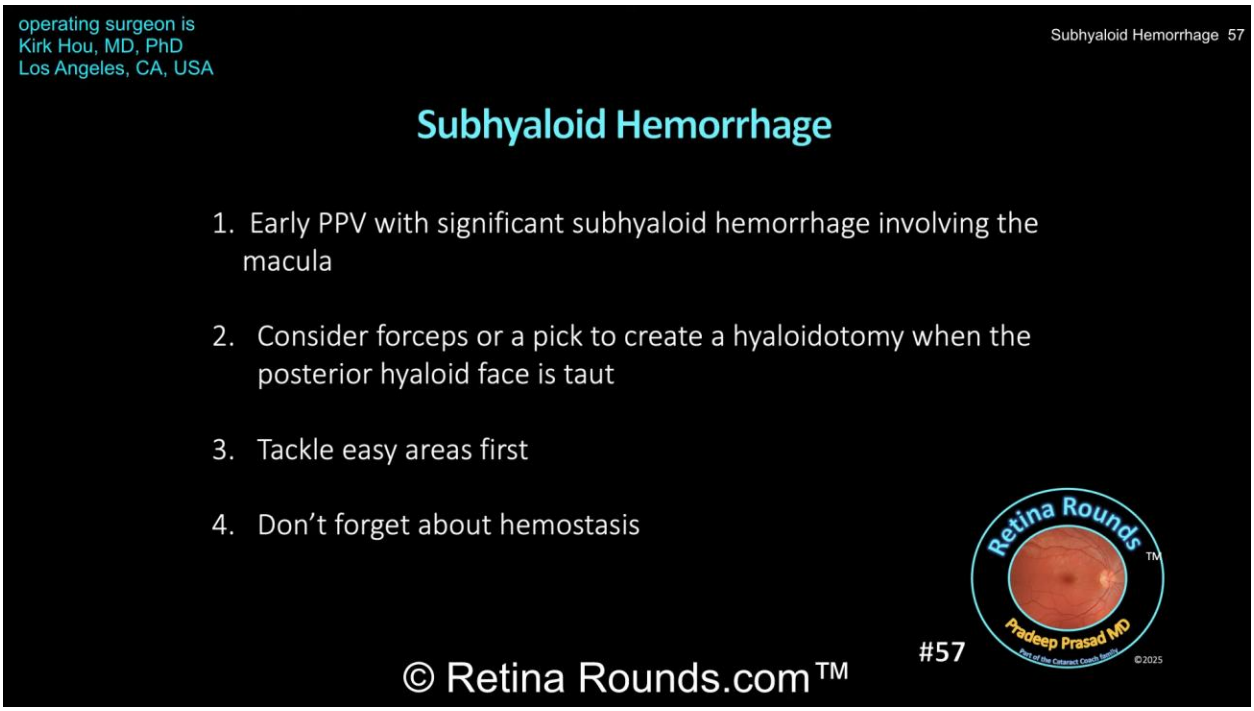
Surgeons can also consider staining and peeling the ILM over the macula to increase macular laxity and decrease the risk of postoperative ERM formation.

Again, this is a challenging case that was beautifully managed by Dr. Lozano. We want to thank him for sharing this case and for giving us all an opportunity to learn more about PVR associated retinal detachment management. Thanks for watching.

- **Subhyaloid Hemorrhage**

Link: https://www.youtube.com/watch?v=kJuszSNTqwg

Returning guest surgeon Dr. Kirk Hou shows us how to manage some common difficulties when performing diabetic vitrectomy. Here he demonstrates a challenging case in a patient with a macula-involving subhyaloid hemorrhage. Thanks Dr. Hou for sharing this video!



Subhayloid hemorrhages, especially those seen with proliferative diabetic retinopathy, are a subtype of hemorrhage that really deserve special attention.

When the poster hyoid face is intact and there's a significant subhayloid hemorrhage in the macula, early vitrectomy is a good idea. The reason is that a hemorrhage can trigger an inflammatory response that can result in recruitment of inflammatory cells, inflammatory mediators, neutrophils, macrophages and this can subsequently result in contraction of the hyoid.

For a subhayloid hemorrhage, you have to remember that the diabetic blood is rich in fibrin and that makes it highly adherent. So, when blood is compressed between the hyaloid face and the underlying macula, contraction of the hyaloid can easily translate to macular traction and subsequent macular detachment. Since the posterior hyaloid face may be taught, using forceps or a pick as was demonstrated in this case can be useful to create a posterior hyaloidotomy and this can allow for the blood to be evacuated if it's sufficiently liquefied, or in this case when the when the blood is a little bit more clotted, it does allow for hydro dissection of the hyaloid away from the blood and the retina and for space to be created that'll make dissection a bit easier.

Diabetic vitrectomies are a little like a puzzle which I think makes them challenging but fun at the same time. One area presents a problem or introduces too much risk. I would recommend trying to go to an easier area first. Dr. Hou demonstrated this. You know when he was working over the macula, he did what he could. There was some concern that maybe further dissection or manipulation in areas where he couldn't see completely might introduce the risk for some macular pathology, so he worked on the nasal part of the retina in a safer area where he had better visualization, and when you come back to that difficult area it can be some often times

easier to manage as in this case when the hyaloid was propagated nasally and then brought around temporally making the temporal segmentation and delamination easier.

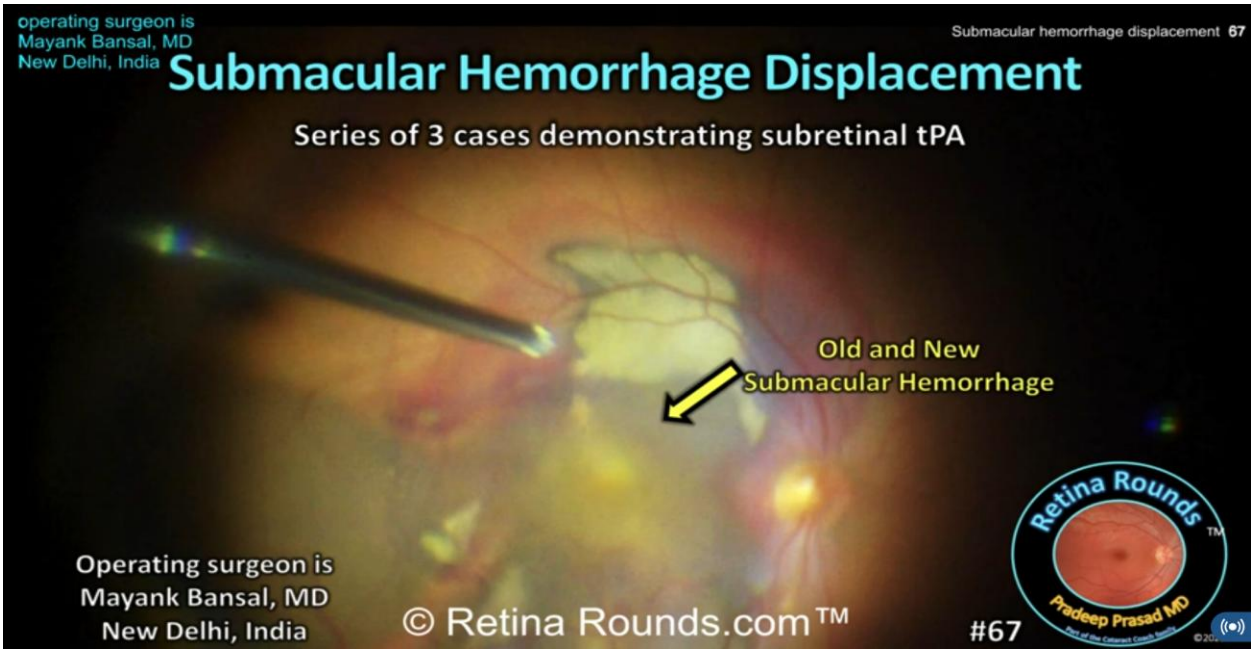
Finally, don't forget about homoeostasis. Uncontrolled bleeding can result in clots that are difficult to dissect off the retina and can prolong the surgery. When achieving homoeostasis with tamponade, you should remember not to leave the infusion pressure up too long as this can further damage the ischemic tissue. You want to get quick control. You can use tamponade pressure and then use the diathermy to achieve hemostasis.

Now one other step that I like to perform is to lower the pressure to a physiologic level. Often times we're operating at intraocular pressures of 25 to even 35, and that's not the pressure that the patient will be in in the post-operative period. So, when you are trying to assess for adequate homoeostasis, lowering the pressure to a more physiologic level; say 15 mmHg or even lowering the pressure further to 5 or 10 mmHg to really see whether or not there are any oozing vessels is a good idea to make sure that you've got good hemostasis. That's going to help decrease the chance for postoperative vitreous hemorrhage and it will help to speed up the patient's visual recovery.

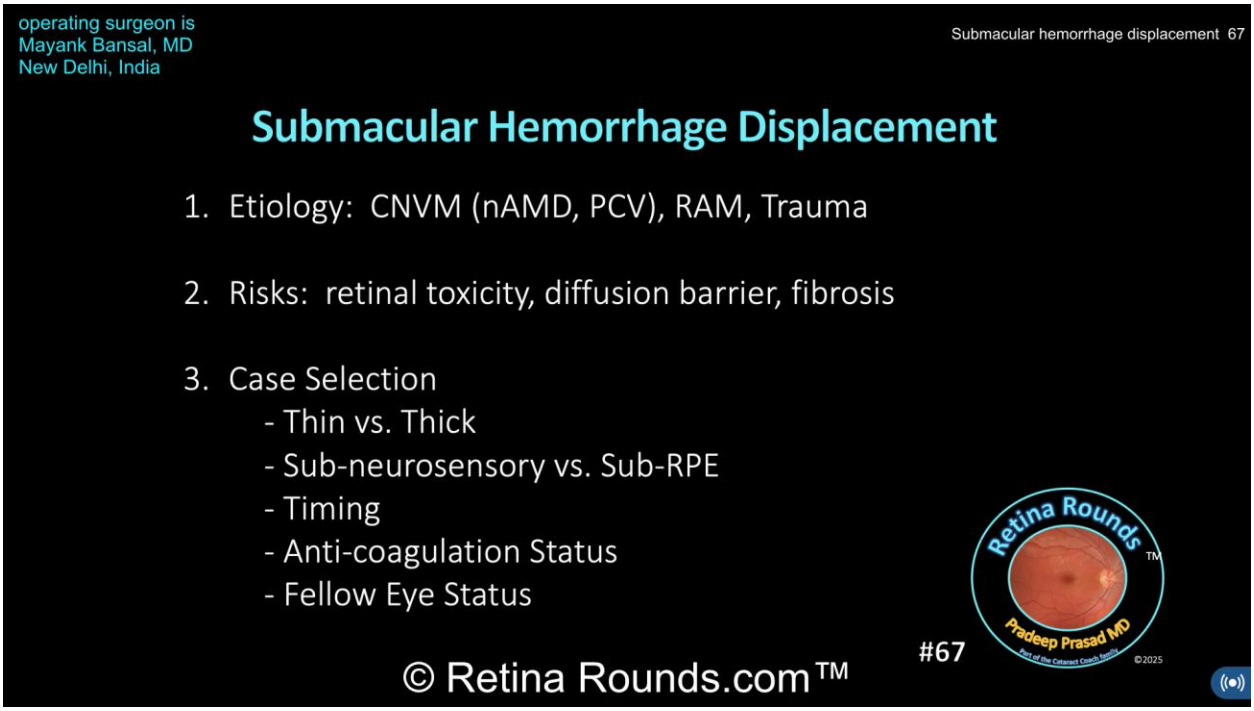
Again, thank you Dr. Hou for sharing this case. This really gives us a great opportunity to review some of the important fundamental concepts of diabetic vitrectomy and to highlight uh subhyaloid hemorrhage as an entity that really needs more urgent intervention. This is a beautifully performed surgery and I hope everybody enjoyed watching.

- **Submacular Hemorrhage Displacement**

Link: https://www.youtube.com/watch?v=3Kz3xxwm9SI



In today's episode we welcome back guest surgeon Dr. Mayank Bansal for a series of 3 cases of submacular hemorrhage associated with polypoidal choroidal vasculopathy. Dr. Bansal demonstrates the use of vitrectomy, submacular delivery of tPA and aflibercept and air fluid exchange for the displacement of submacular hemorrhage. We want to thank Dr. Bansal for sharing these cases and to see more surgeries from Dr. Bansal, please visit his YouTube channel and website.



So here are a few uh take-home points.

Submacular hemorrhage may be secondary to a variety of diseases and most commonly is going to be due to a choroidal vascularization from either neovascular AMD or polypoidal choroidal vasculopathy but can also occur in association with other conditions like retinal arterial macroaneurysms and trauma. Patients with choroidal neovascularization for whom anti-VEGF therapy has been stopped due to apparent clinical quiescence may be at particular risk for these hemorrhagic events.

Submacular hemorrhages especially thicker hemorrhages may result in photoreceptor damage from a variety of mechanisms including iron associated retinal toxicity or blockage of diffusion between the underlying RPE and the outer retina and/or fibrosis which can result in traction in the outer retina and this damage can occur within days and so early intervention generally results in better outcomes.

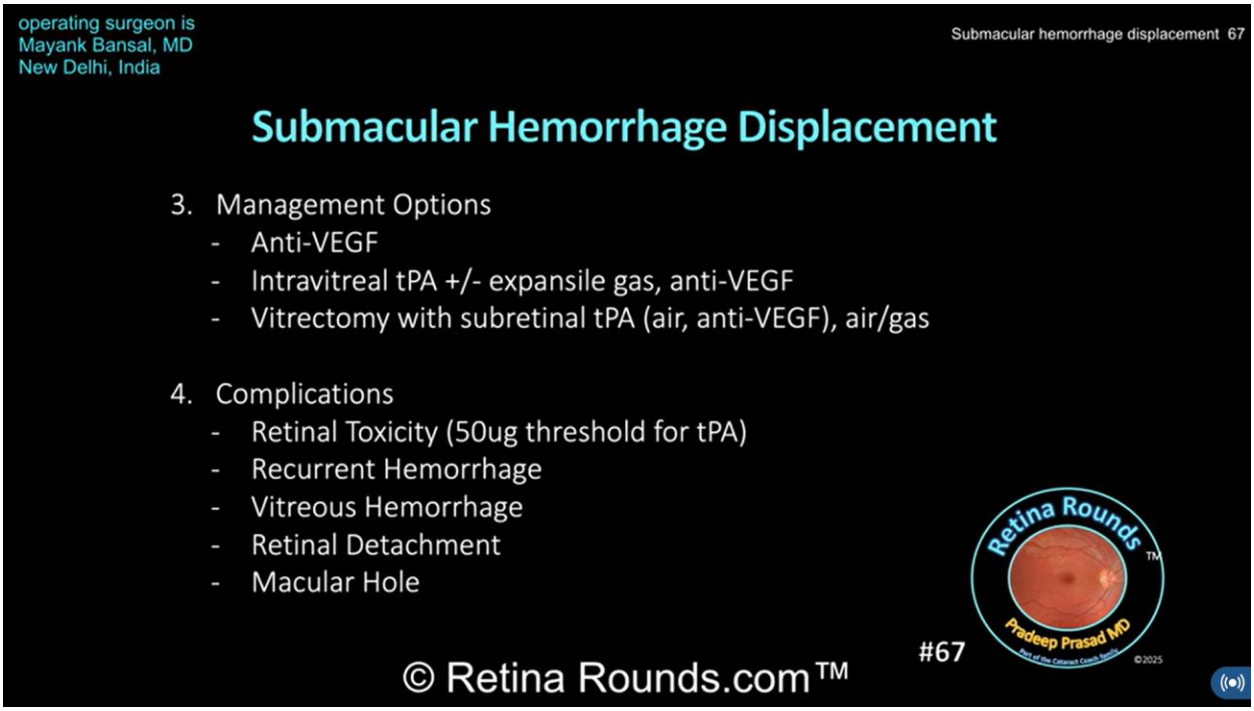
When considering submacular hemorrhage displacement, case selection is very important. The degree of hemorrhage for example matters. Thin hemorrhages often can be treated with monthly anti-VEGF injections. However, thicker hemorrhages may require greater intervention.

The location of the hemorrhage also matters. Sub-neurosensory hemorrhages are amendable to displacement whereas predominantly sub-RPE hemorrhages do not displace. Pre-operative OCT when possible is very important to help determine the location of the hemorrhage.

Now with respect to visual recovery, timing also matters with better results, when intervention is performed within days and visual recovery may also be seen in hemorrhages that are present for 1 to two weeks. However, the longer the duration of the hemorrhage the lower the likelihood of vision improvement.

Anti-coagulation status should also be determined. Often times, these patients may be anti-coagulated and particularly those who are on multiple anti-coagulation medications may be at higher risk for a large submacular hemorrhages. A consultation with the patients' medical providers is prudent to help determine if the anti-coagulation medication can be stopped or reduced especially prior to any planned surgical intervention.

One should also take into account the patient's fellow eye status. Poor vision in the fellow eye or a history of hemorrhage in the fellow eye and the associated outcome of any intervention that was employed may help to guide how aggressive the surgeon wants to be in the newly affected eye, and as always, the risks and benefits of intervention should be discussed thoroughly with the patient.



Management in the vast majority of cases should include at minimum ongoing anti-VEGF injections. Anti-VEGF injections alone is typically going to be reserved for mild or thin submacular hemorrhages. But for thicker hemorrhages, one can consider either intravitreal injection of tPA with or without the injection of an expansile gas bubble or a vitrectomy with subretinal injection of tPA and possibly also subretinal injection of air and/or an anti- VEGF medication.

Now pneumatic uh displacement can be achieved either by performing an air fluid exchange and leaving the eye air filled or using a short acting gas tamponade and either a complete or a partial air fluid exchange can be performed.

Post-operative positioning could include face down positioning, upright positioning with the head tilted down to displace the hemorrhage inferiorly or the patient could be positioned on their side with the

nasal side up to displace the hemorrhage temporally. You know tPA has a relatively short acting half-life and positioning anywhere from 1 to 3 days or even up to 5 days is typically adequate.

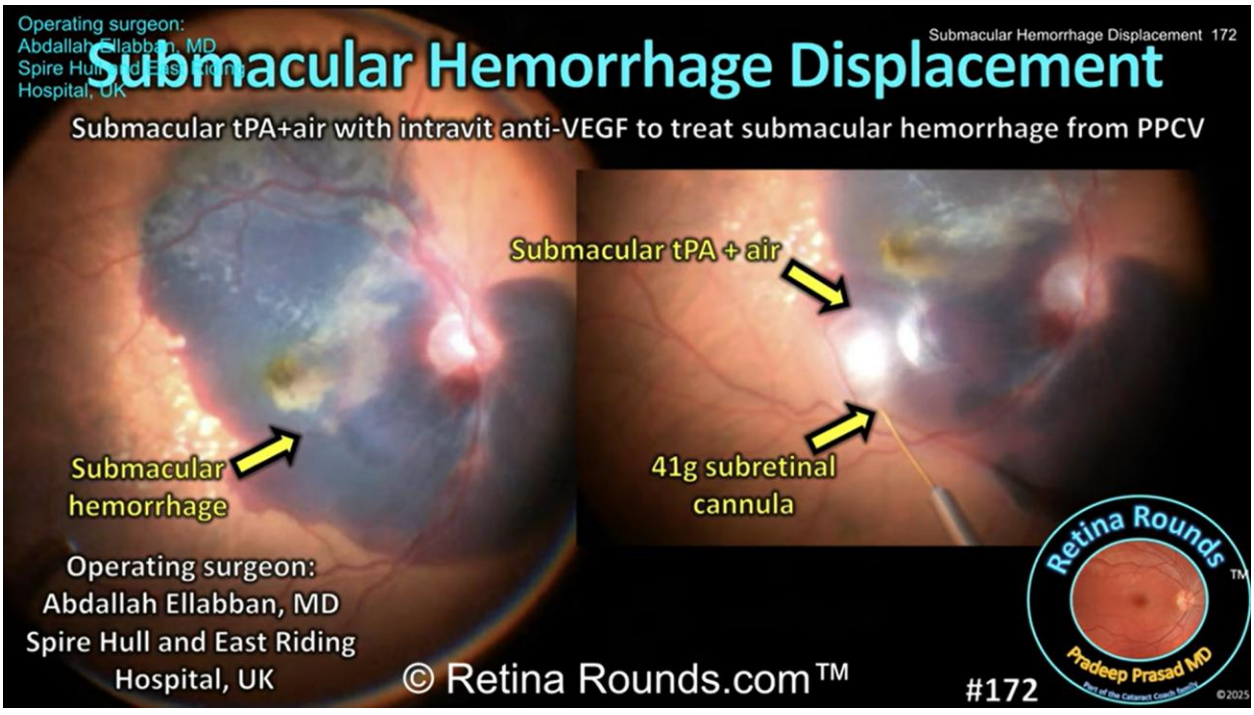
Complications of surgical displacement include retinal toxicity associated with subretinal tPA injection. While the toxic dose of tPA in the eye has not been established, many studies suggest that doses at or **above 50 micrograms** increases the risk of toxicity. **So, our approach is to use a dose of 12.5 micrograms per 0.1 cc with a volume of about 0.3 cc injected**. This can be combined with a cocktail of anti-VEGF medication and potentially also a trailing air bubble which will allow for pneumatic displacement both in the subretinal space as well as any pneumatic displacement that can be achieved from the vitreous cavity. Additionally, rather than injecting anti-VEGF medications in the subretinal space, anti-VEGF medication can also be injected intravitally towards the end of the case.

Other complications of surgery include recurrent hemorrhage, vitreous hemorrhage, retinal detachment which risk is higher in these cases than the risk of RD with vitrectomy for other indications and macular hole formation. Slow subretinal injection can decrease the risk of macular blowout with hole formation and injection can be performed either with an experienced assistant or with the vitrectomy machine foot pedal using the viscous fluid injection mode at a low PSI and a micro dose injection kit.

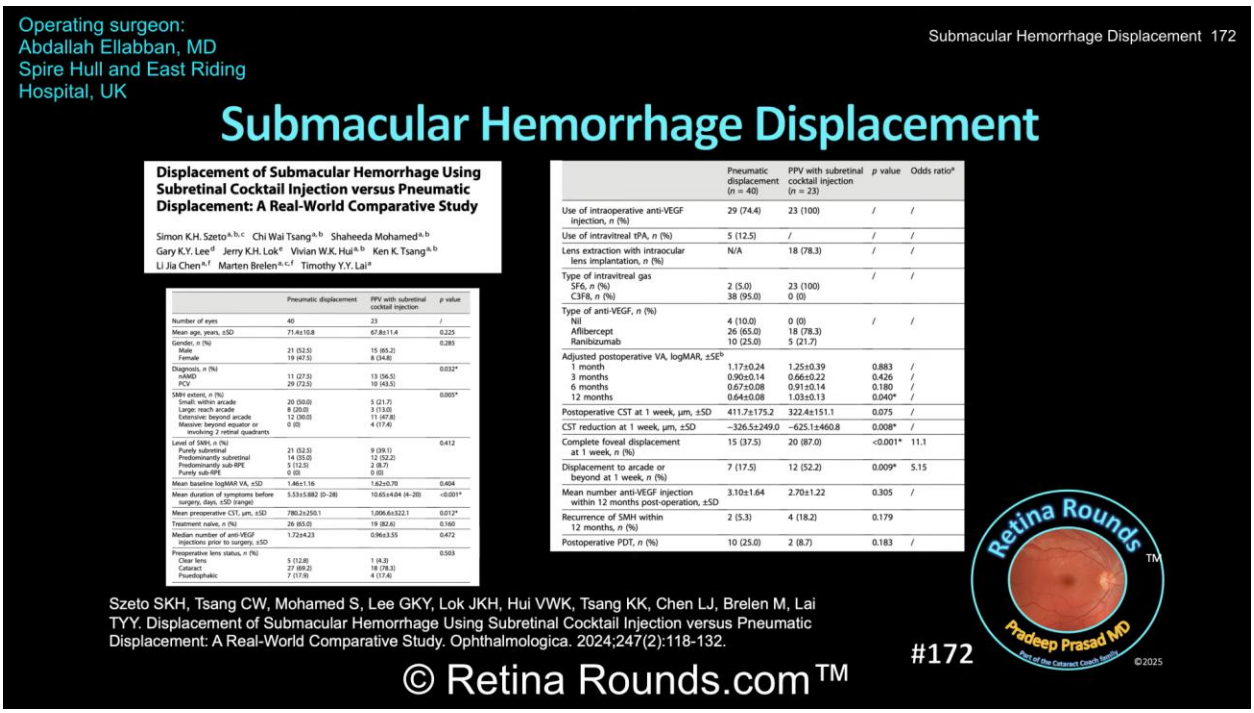
Again, we want to thank Dr. Bansal for sharing these cases and for giving us an opportunity to learn more about submacular hemorrhage displacement as well as the use of TPA. We'll see you again next time.

Submacular hemorrhage displacement

Link: https://www.youtube.com/watch?v=zJfE3s3yyRM



Submacular hemorrhage is a vision-threatening complication of polypoidal choroidal vasculopathy, neovascular AMD, retinal arterial macroaneurysms and other retinal diseases. Management options include clinic-based pneumatic displacement and surgical displacement. Our very special guest surgeon is Dr. Abdallah Ellabban, senior consultant at Spire Hull and East Riding Hospital in the UK. Dr. Ellaban shows us a beautiful case of surgical submacular hemorrhage displacement using subretinal tPA, air and intravitreal anti-VEGF. The anatomic and functional outcomes are truly outstanding. At the end of the case we will review the pros and cons of pneumatic vs. surgical displacement as well as some potential complications to be aware of. Thank you Dr. Ellaban for sharing this case!



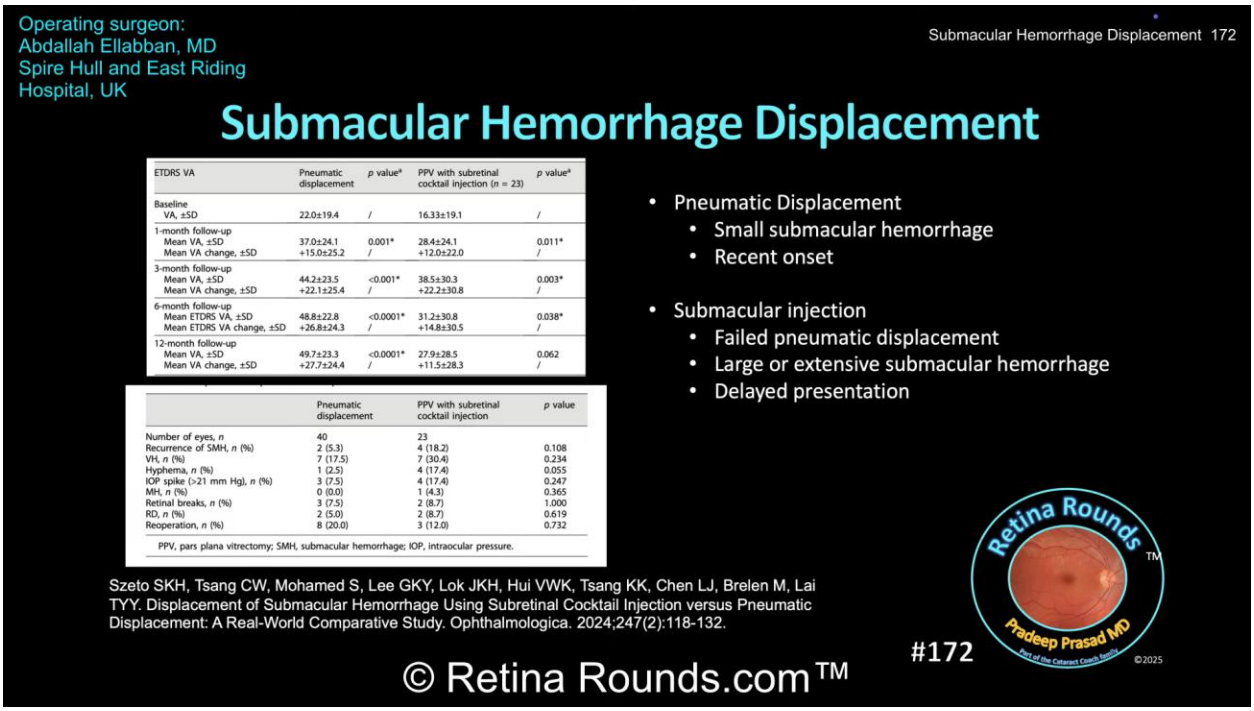
	Pneumatic displacement (n = 40)	PPV with subretinal cocktail injection (n = 23)	p value	Odds ratio[a]
Use of intraoperative anti-VEGF injection, n (%)	29 (74.4)	23 (100)	/	/
Use of intravitreal tPA, n (%)	5 (12.5)	/	/	/
Lens extraction with intraocular lens implantation, n (%)	N/A	18 (78.3)	/	/
Type of intravitreal gas			/	/
SF6, n (%)	2 (5.0)	23 (100)		
C3F8, n (%)	38 (95.0)	0 (0)		
Type of anti-VEGF, n (%)				
Nil	4 (10.0)	0 (0)	/	/
Aflibercept	26 (65.0)	18 (78.3)		
Ranibizumab	10 (25.0)	5 (21.7)		
Adjusted postoperative VA, logMAR, ±SE[b]				
1 month	1.17±0.24	1.25±0.39	0.883	/
3 months	0.90±0.14	0.66±0.22	0.426	/
6 months	0.67±0.08	0.91±0.14	0.180	/
12 months	0.64±0.08	1.03±0.13	0.040*	/
Postoperative CST at 1 week, μm, ±SD	411.7±175.2	322.4±151.1	0.075	/
CST reduction at 1 week, μm, ±SD	−326.5±249.0	−625.1±460.8	0.008*	/
Complete foveal displacement at 1 week, n (%)	15 (37.5)	20 (87.0)	<0.001*	11.1
Displacement to arcade or beyond at 1 week, n (%)	7 (17.5)	12 (52.2)	0.009*	5.15
Mean number anti-VEGF injection within 12 months post-operation, ±SD	3.10±1.64	2.70±1.22	0.305	/
Recurrence of SMH within 12 months, n (%)	2 (5.3)	4 (18.2)	0.179	
Postoperative PDT, n (%)	10 (25.0)	2 (8.7)	0.183	/

	Pneumatic displacement	PPV with subretinal cocktail injection	p value
Number of eyes	40	23	/
Mean age, years, ±SD	71.4±10.8	67.8±11.4	0.225
Gender, n (%)			0.285
Male	21 (52.5)	15 (65.2)	
Female	19 (47.5)	8 (34.8)	
Diagnosis, n (%)			0.032*
nAMD	11 (27.5)	13 (56.5)	
PCV	29 (72.5)	10 (43.5)	
SMH extent, n (%)			0.005*
Small: within arcade	20 (50.0)	5 (21.7)	
Large: reach arcade	8 (20.0)	3 (13.0)	
Extensive: beyond arcade	12 (30.0)	11 (47.8)	
Massive: beyond equator or involving 2 retinal quadrants	0 (0)	4 (17.4)	
Level of SMH, n (%)			0.412
Purely subretinal	21 (52.5)	9 (39.1)	
Predominantly subretinal	14 (35.0)	12 (52.2)	
Predominantly sub-RPE	5 (12.5)	2 (8.7)	
Purely sub-RPE	0 (0)	0 (0)	
Mean baseline logMAR VA, ±SD	1.46±1.16	1.62±0.70	0.404
Mean duration of symptoms before surgery, days, ±SD (range)	5.53±5.882 (0–28)	10.65±4.04 (4–20)	<0.001*
Mean preoperative CST, μm, ±SD	780.2±250.1	1,006.6±322.1	0.012*
Treatment naive, n (%)	26 (65.0)	19 (82.6)	0.160
Median number of anti-VEGF injections prior to surgery, ±SD	1.72±4.23	0.96±3.55	0.472
Preoperative lens status, n (%)			0.503
Clear lens	5 (12.8)	1 (4.3)	
Cataract	27 (69.2)	18 (78.3)	
Pseudophakic	7 (17.9)	4 (17.4)	

Here are some take-home points. Now, in previously in episode 67, we've discussed some general principles of submacular hemorrhage displacement as well as a safe dosing of tPA. If you haven't already, be sure to check out that episode. Here I'd like to dive a bit deeper into pneumatic displacement which is a less invasive clinic-based approach versus surgical submacular displacement.

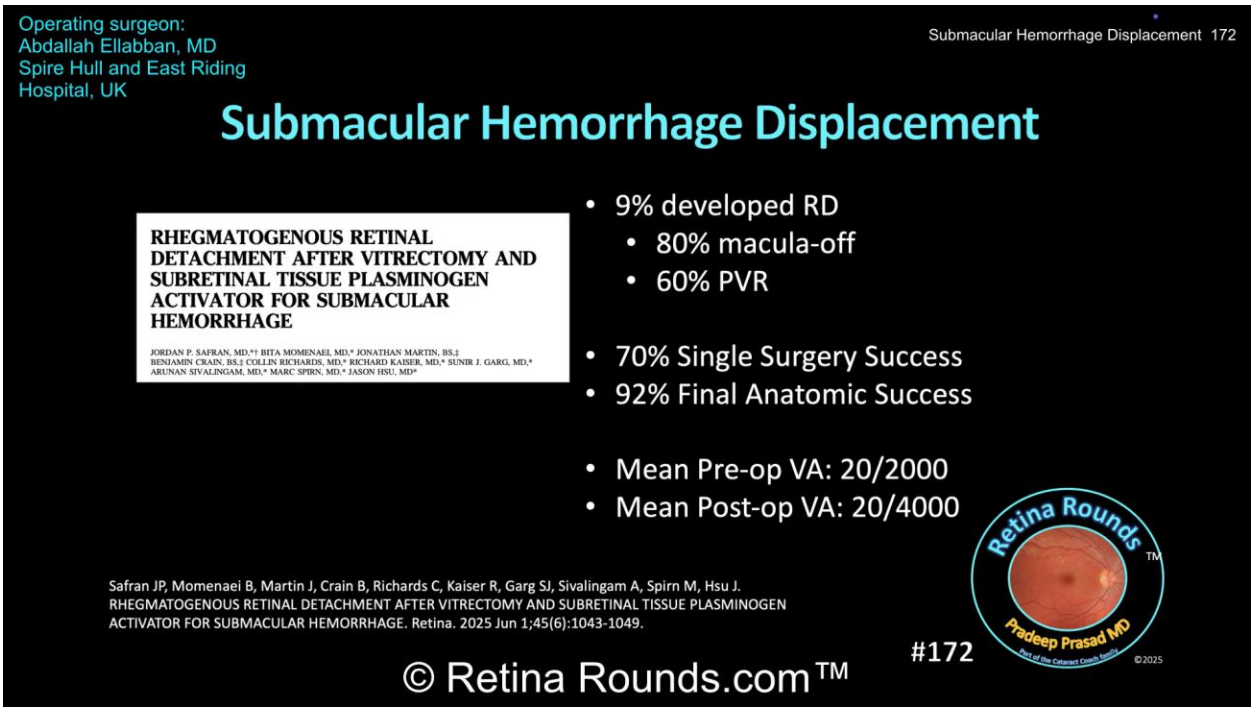
Now in this retrospective study by Simon Szeto and colleagues the anatomic and functional outcomes of patients undergoing pneumatic displacement using intravitreal gas with or without tPA and anti-VEGF surgical displacement with a submacular injection of a cocktail of 50 micrograms of tPA in 0.4 mL, 0.05 mL of either aflibercept or ranibizumab and 0.2 mL of filtered air with a partial vitreous cavity air fluid exchange and implantation of expansile SF6 gas.

Patients undergoing surgical displacement were more likely to have hemorrhage from neovascular AMD were more likely to have larger and more extensive submacular hemorrhage and a longer mean duration of symptoms about 10 and 1/2 days for the surgery group versus 5 1/2 days for the pneumatic group. Patients undergoing surgical displacement were more likely to have complete foveal and macular hemorrhage displacement.



However, when we look at visual outcomes, we see that post-operative vision improved in both groups throughout the post-operative period. Vision was significantly better than baseline in both groups through 6 months postop and this persisted through postop month 12 in the pneumatic group, but was not significantly improved from baseline in the surgical group at postop month 12. Now, this this difference may in part be due to the more severe baseline pathology of patients in the surgical group.

Post-operative complications were not significantly different between the two groups. It should be noted that recurrent submacular hemorrhage was seen more often in the surgical group. Salvage surgical displacement was required in 20% of the pneumatic patients and reoperation was required in 12% of the surgical displacement patients. Retinal detachment was seen in both groups with about a 9% risk in the surgical displacement group. Now given these outcomes and risks, the authors suggest a step-wise approach to submacular hemorrhage displacement. Starting first with pneumatic displacement in patients with smaller submacular hemorrhage or recent onset of symptoms and proceeding to surgical displacement for cases of failed pneumatic displacement, more extensive submacular hemorrhage or patients with delayed presentation.

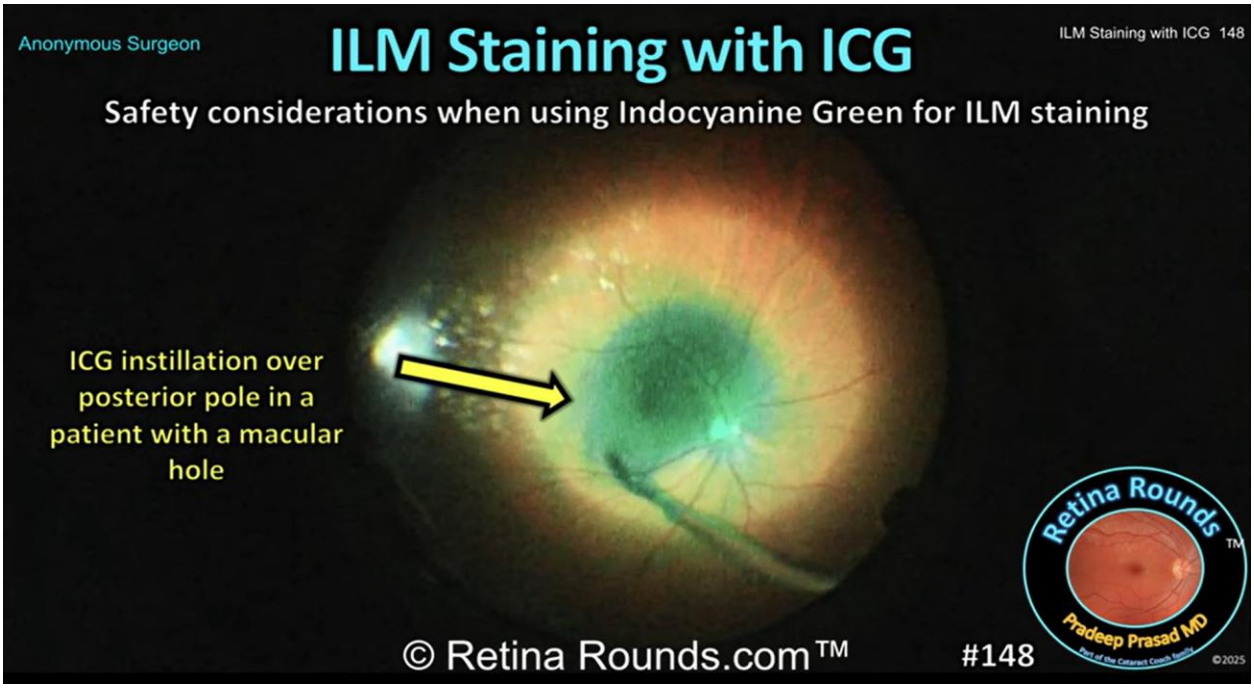


This higher rate of retinal detachment with surgical displacement of submacular hemorrhage was also reported this year by Dr. Dr. Jordan Safran, and colleagues at the Wills Eye Hospital. They also found about a 9% risk of retinal detachment. Of those patients with the retinal detachment, 80% were macula off and 60% had PVR. The single surgery success rate was 70% and the final anatomic success rate was 92%.

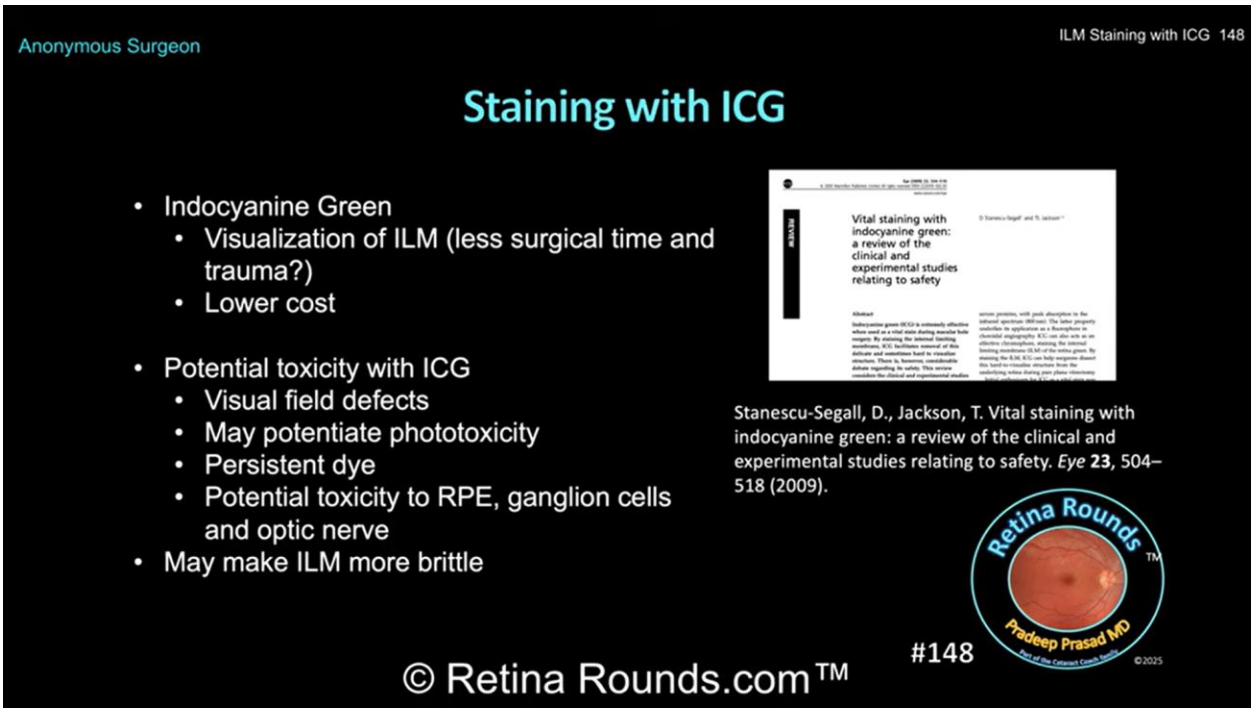
Mean pre-operative vision prior to any intervention and mean final vision were very poor in this group of patients that developed retinal detachment. The risk of retinal detachment as well as the risk of macular hole formation should be discussed with any patient undergoing surgical displacement. Nonetheless, anatomic and functional outcomes can be quite impressive as was demonstrated by Dr. Elllabban. Fortunately, his patient did extremely well. Again, we want to thank Dr. Elllabban for sharing this case and for giving us all an opportunity to learn more about submacular hemorrhage displacement. Thanks for watching.

- **ILM Staining with ICG**

Link: https://www.youtube.com/watch?v=u2tTvouj-rw



Indocyanine green (ICG) effectively stains the ILM, thereby facilitating visualization and potentially improving surgical efficiency. While ICG can be a lower-cost alternative to Brilliant Blue dye, it's use for ILM staining is off-label and may increase the risk of RPE, retina and optic nerve toxicity. Let's take a look at ICG usage in today's case shared by an anonymous surgeon. At the end we will discuss the safety concerns and best practices when using ICG to stain ILM.



Now, here are some take-home points.

As you can see from this case, ICG is an effective stain of the ILM. And as we've discussed previously, good visualization allows for better surgery. Visualization of the ILM can potentially make the surgery more efficient and lead to less iatrogenic trauma to the retina when fracturing and peeling the ILM. While many surgeons have switched to brilliant blue dye to stain ILM due to its own label status and safety profile, ICG is still used by some surgeons since it is potentially a lower cost alternative.

The concern, however, is that ICG can be associated with toxicity. For example, visual field defects have been reported with respect to phototoxicity. While that can happen in any retina surgery, especially macular surgery, there is some evidence that ICG may potentiate phototoxicity. The die itself can persist for many months after surgery. Finally, both animal and human studies have shown the potential for RPE, ganglion cell and optic nerve toxicity in association with ICG.

Also, ICG itself may make the ILM a bit more stiff, a little bit more brittle, and that makes it more prone to fracturing into strips during peeling. Although, interestingly, that did not appear to be an issue during this case.

If ICG is being used, here are some best practices to maximize safety.

First, you want to use the lowest concentration possible to visualize the ILM. Remember that a dark green stain is not necessary since once the ILM is fractured, even a light stain of the ILM can provide enough contrast to aid in visualization. The ICG comes in a vial of 25 mg along with a 10-cc bottle of solvent, which is just sterile water. Mixing the two gives a concentration of 2.5 mg/ml. Now this solution can then be further diluted in 1:10 or 1:20 ratio to give a lower concentration and that's going to be up to the surgeon preference. Remember too that when injecting into a BSS filled vitreous cavity which

is about 4 cc, the dye will further be diluted and that will depend on the volume of the dye that's injected into the vitreous cavity.

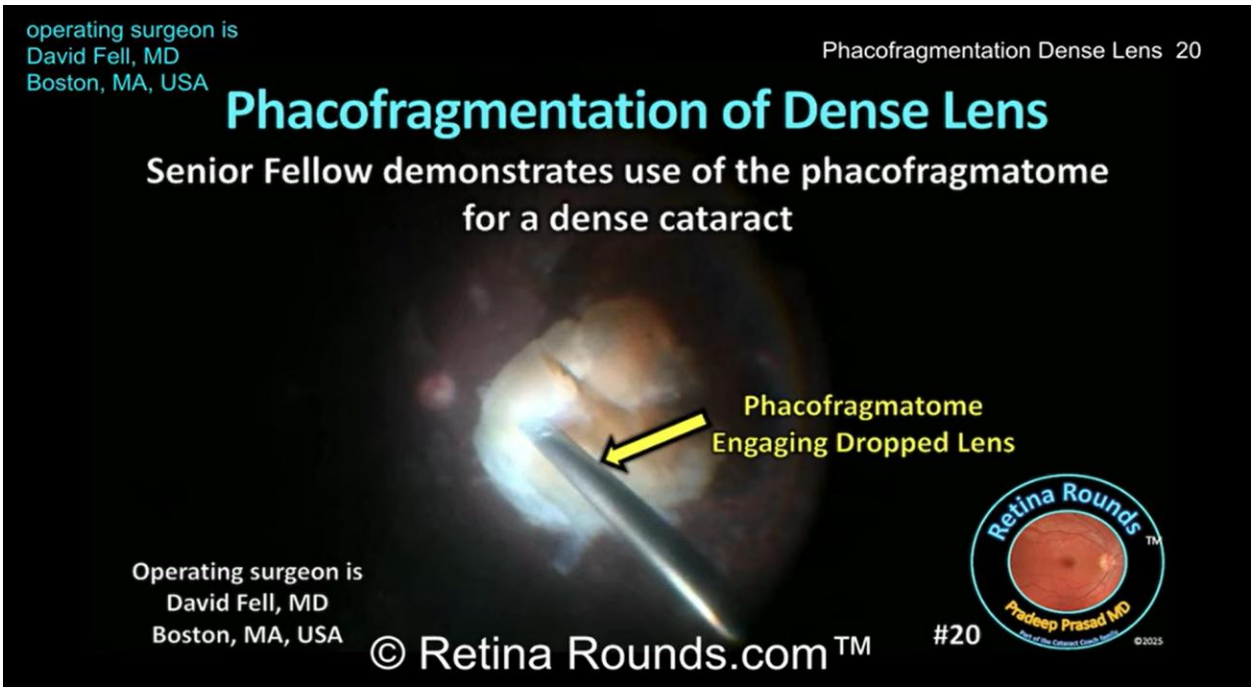
Now using an iso-osmolar solution can improve the safety profile. Remember the aqueous solvent with sterile air is hypo-osmolar and some surgeons favor mixing with either BSS or D5W. A D5W has the added benefit of being heavier so that the die pools over the posterior pole. You want to make sure that the OR staff uses D5 and not D50, which of course is hyper-osmolar.

Now when injecting ICG or any die for that matter, you want to avoid injecting towards the macular hole, especially with a relatively strong jet as was seen in this case. Once the ICG is injected, it should ideally be removed immediately. Now, some surgeons perform an air fluid exchange and then place a few drops of ICG solution over the posterior pole. However, this can increase the effective concentration that the RPE and retina is exposed to and may worsen the safety profile compared to injecting into a BSS filled eye.

Last, it's always good practice to hold the light pipe away from the macula to minimize light exposure duration during macular surgery. Digital viewing systems with digital light filters can be useful to minimize the amount of light that's necessary to get good visualization of the ILM. We want to thank the surgeon for sharing this case. ICG use has been declining in recent years, but we hope this safety review can be helpful to you to mitigate risk if you plan on using this die. Thanks for watching.

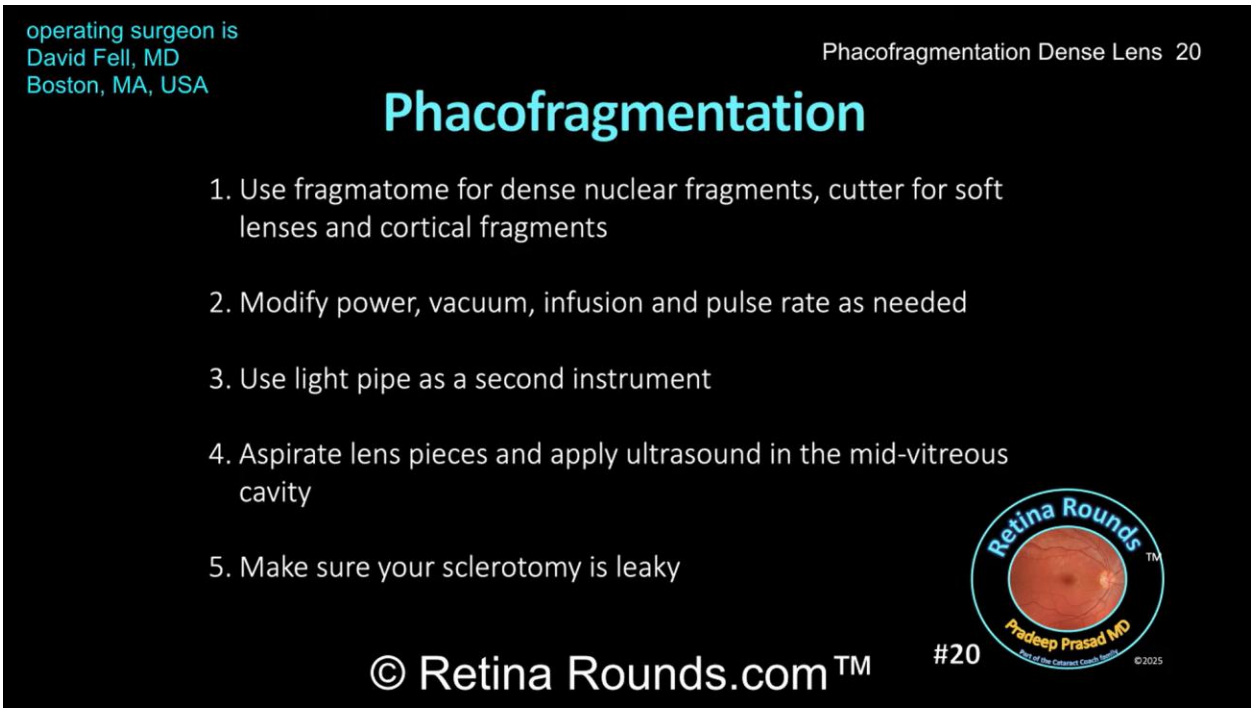
- **Phacofragmentation**

Link: https://www.youtube.com/watch?v=ZIGn_3jcndA



Phacofragmentation is an efficient way to remove dense lens material that has fallen to the posterior pole. In this case, second year Tufts/OCB vitreoretinal fellow David Fell, demonstrates a number of best practices when performing phacofragmentation. These include aspiration the lens material and mobilizing into the mid-vitreous cavity before engaging the ultrasound, using the light pipe as a second

instrument, and creating a sclerotomy that is sufficiently large to avoid phacofrag scleral wound burning. At the end of the video we discuss some of the parameters you can modulate to improve the efficiency and safety of phacofragmentation. Future videos will provide a more detailed explanation of these various machine settings. Thank you Dr. Fell for sharing this very educational video!



Here are your take-home points:

The fragmatome is a very useful instrument to remove dense nuclear fragments that would otherwise be removed with the vitrectomy cutter in a very inefficient manner or could not be removed with the vitrectomy cutter, it is good, though, to reserve the vitrectomy cutter for removal of either softer lenses or for the removal of cortical fragments.

Second, it's important to remember that there are a number of parameters that can be modified to improve the efficiency of fragmentation include modifying the power, the vacuum, and pulse rate. With respect to power for very dense lens material, it's important to use a higher power in order to efficiently emulsify the lens material, vacuum should generally be kept at a low level and that's because this is a larger gauge instrument and so out stripping the infusion or having post occlusion surge can be an issue, and higher vacuum levels can exacerbate that problem; however, if you're finding that there is poor followability or a poor purchase of the lens material, the vacuum can be increased. With respect to pulse rate, there can sometimes be almost like a jackhammer effect. When the ultrasound energy is being administered, the lens material actually gets pushed away or gets repulsed away from the tip of the fragmatome, and in these cases it can be helpful to lower the pulse rate. Basically, what that does is it allows more time between the administration of the phacofragmentation energy to allow for that lens material to get aspirated and to get adequate purchase and inclusion of the fragmatome tip. Finally, with respect to infusion: Important again to remember that it's very easy to outstrip infusion and to cause scleral infolding

so make sure if you're finding there is significant or recurrent scleral infolding during this procedure, the infusion pressure is increased to account for the increased flow through the larger bore fragmatome hand piece the as is nicely demonstrated in this case.

The light pipe can be used as a second instrument and that can be very helpful during fragmentation to stabilize the lens material to guide it towards the opening or the fragmatome handpiece and also to use it as a chopper to mechanically break a lens material into smaller pieces. The best practice when doing fragmentation is to carefully aspirate the lens pieces and then once those lens pieces are brought up into the mid vitreous cavity to then engage the ultrasound that can either be done depending on the foot pedal settings; can be done by going all the way down on the foot pedal or going the foot pedal to the right to engage the ultrasound. It's important to do that in the mid vitreous cavity to avoid any iatrogenic damage to the retina.

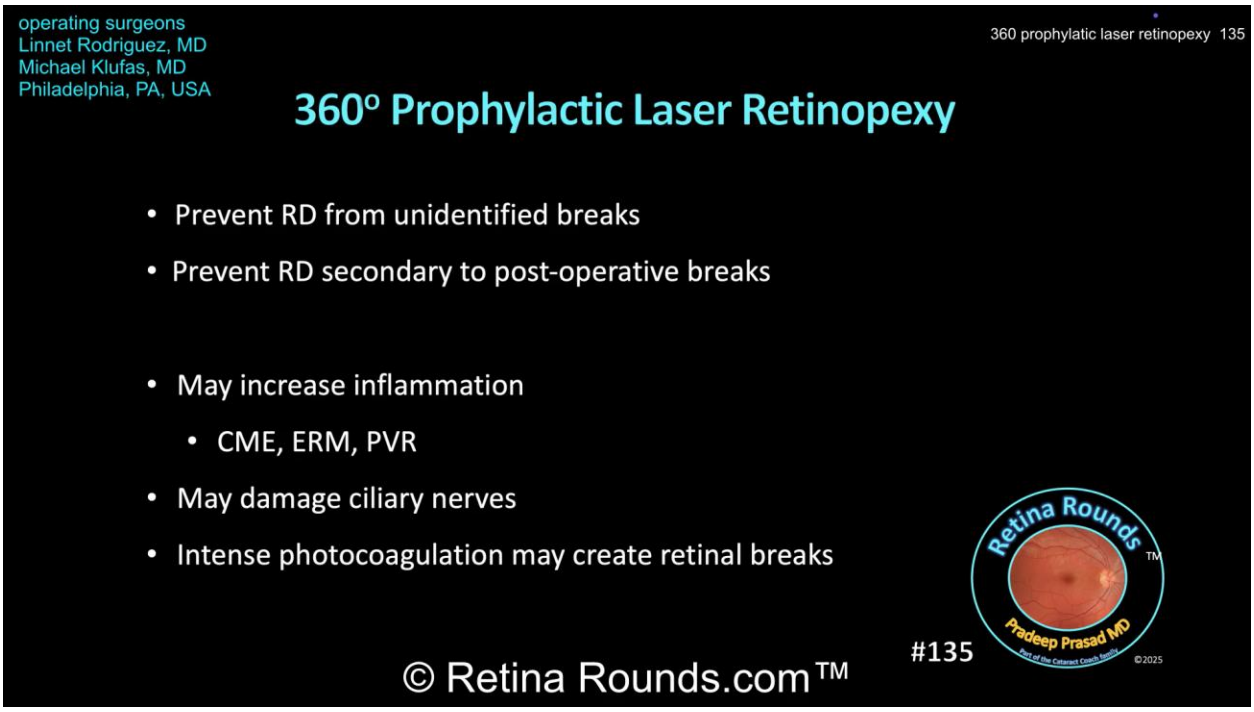
Finally, it’s important to make the sclerotomy a bit larger than the size of the fragmatome handpiece itself because when the ultrasound is being turn, heat is generated along the tip and the and up the shaft of the fragmatome hand piece, you need to have some BSS flow around the handpiece to make sure the surrounding structures don't overheat and in particular at the sclerotomy just as one might get a wound burn of the cornea, you can also get a fragmatome wound burn of the sclera which can be very challenging to close. I like to make the sclerotomy as a separate as a separate sclerotomy for the fragmatome hand piece rather than removing the trocar and then merging it to accommodate a fragmatome but both are acceptable approaches.

Lastly, it's certainly reasonable to protect the retinal surface or the macular surface during this process. Sometimes the lens material can be a bit sharp and can potentially damage the macula and so using either perfluorocarbon liquid or viscoelastic over the macula can help to mitigate this risk. Once again, I want to thank Dr Fell for sharing this case with us. A lot of great learning points and a very nice demonstration of how to use the phacofragmentation probe to remove dense lens material.

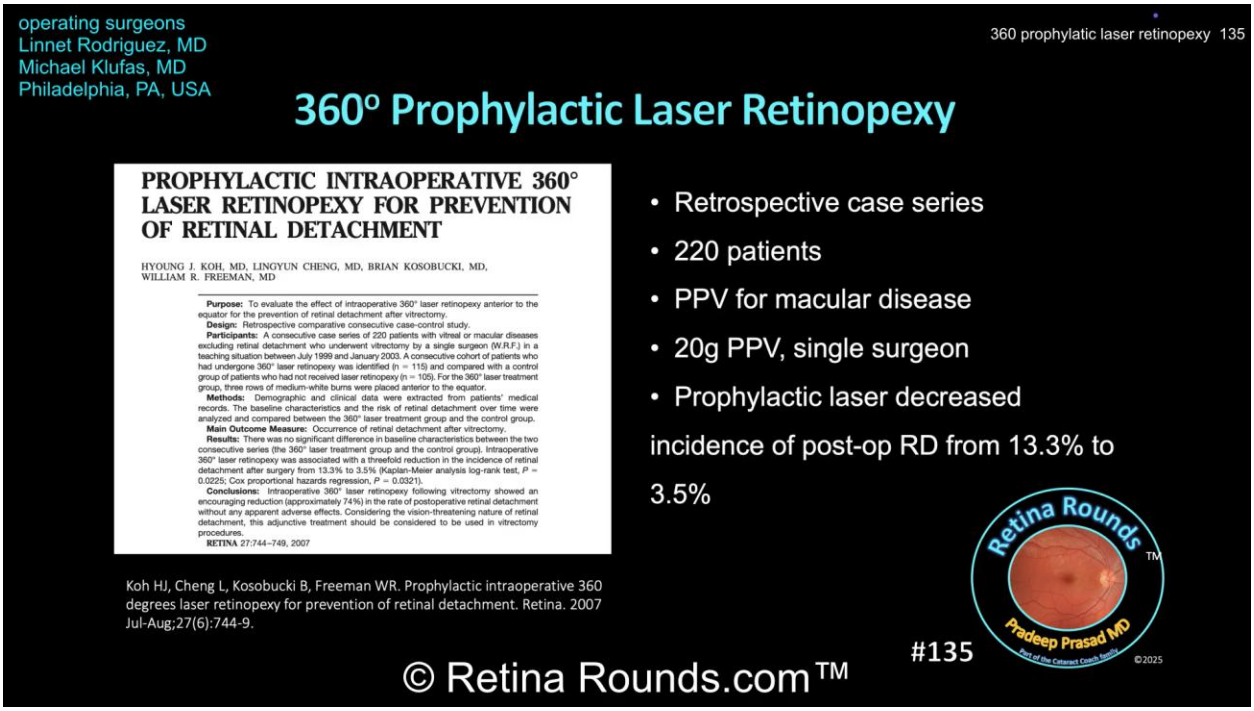
- **360 Degree Prophylactic Laser Retinopexy**

Link: https://www.youtube.com/watch?v=3GEs94qDkbk&t=35s

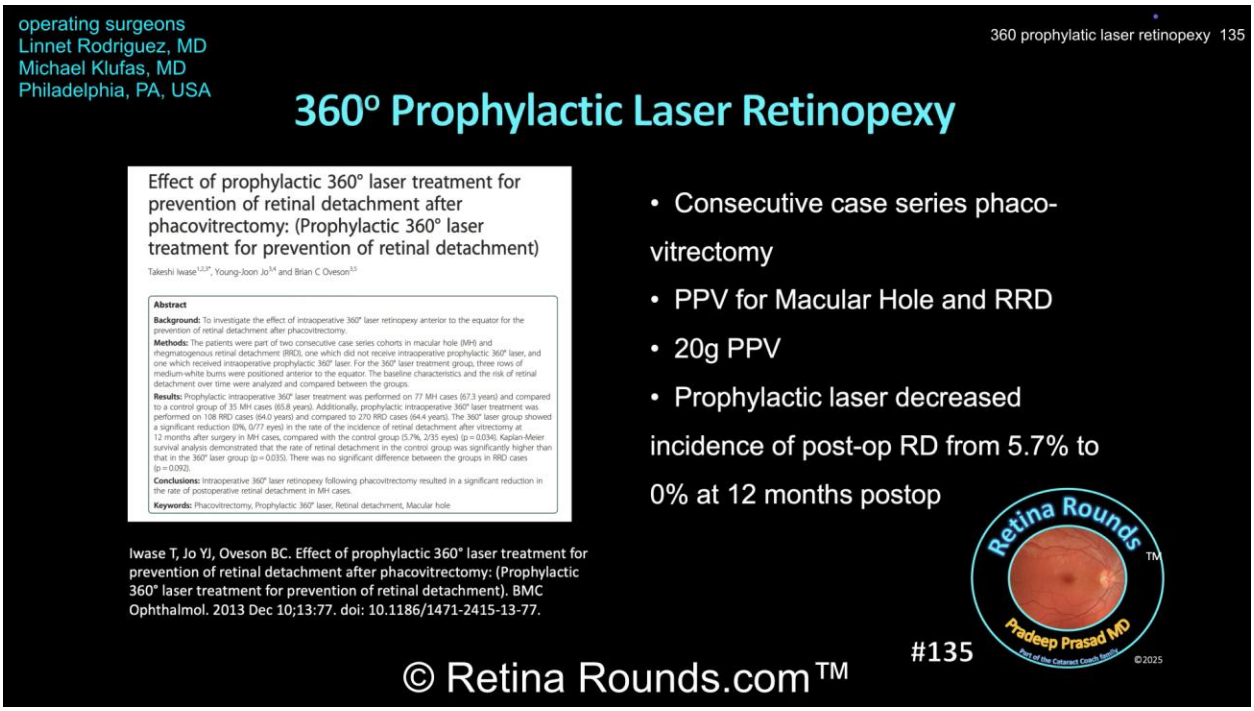
Retinal detachment is a feared complication following pars plana vitrectomy. 360-degree prophylactic peripheral laser retinopexy has been proposed as a technique to decrease the risk of postoperative RD. It's a topic that has been brought up by some of the Retina Rounds viewers and so today we will do a deeper dive on the topic. The patient in this video, presented by guest surgeon of the week Dr. Michael Klufas, is undergoing a vitrectomy for an epiretinal membrane and symptomatic floaters. Of note, the patient has previously undergone laser barricade of a localized peripheral retinal detachment. To prevent a post-operative retinal detachment, Dr. Klufas and his fellow at the time, Dr. Linnet Rodriguez, perform prophylactic 360-degree laser retinopexy. Let's see how the case goes and at the end we will review some of the literature on the topic. Thank you Dr. Klufas for sharing this case!



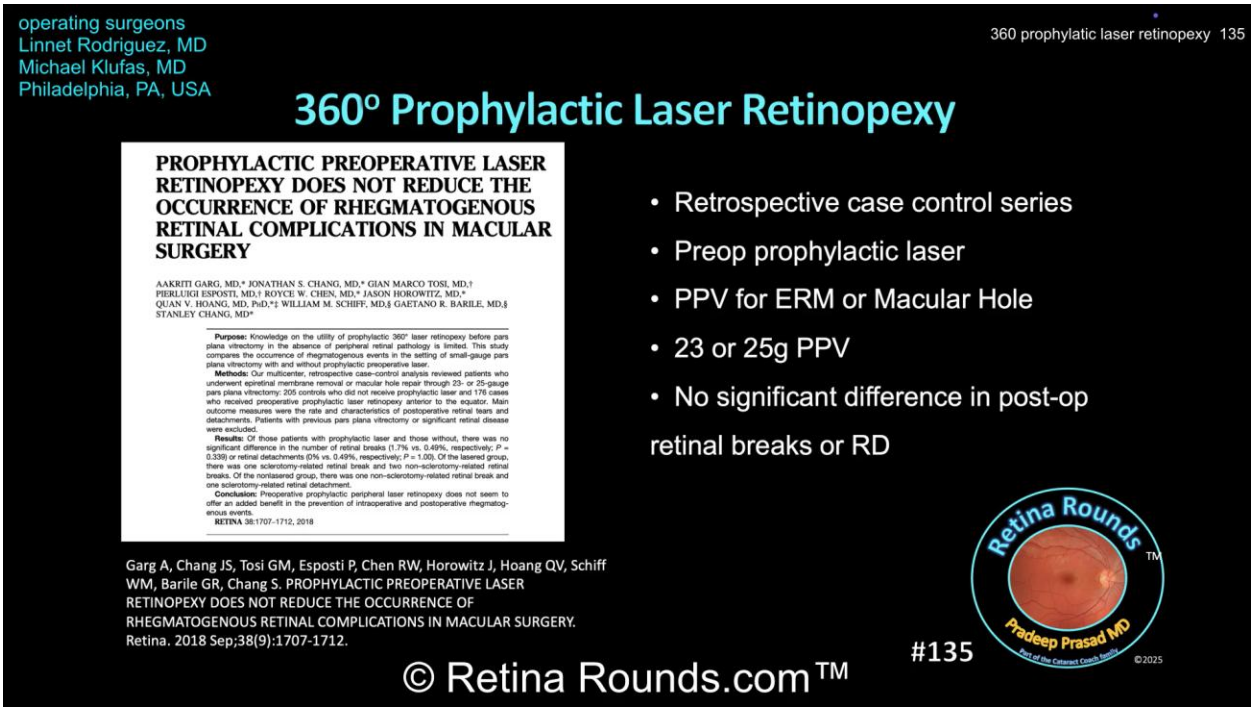
So here are some discussion points. You know the argument in favor of performing 360° prophylactic laser retinopexy is that it can prevent a post-operative retinal detachment either from unidentified retinal breaks during the surgery or post-operative retinal breaks from contraction of the residual vitreous proximal to the vitreous base. Now the counterargument against performing prophylactic laser is that it isn't entirely clear that this is a necessary step. Certainly, adds some time to the surgery potentially cost if otherwise a laser probe wouldn't be open for the surgery and 360° laser may increase inflammation thereby causing CME or ERM formation although that point is debatable. It can exacerbate PVR in patients who are undergoing vitrectomy for retinal detachment. Laser at the three o'clock and nine o'clock hour positions may damage the ciliary nerves and that can cause loss of accommodation, mydriasis and neurotrophic keratopathy. Also, intense photocoagulation may actually create retinal breaks.



So, what does the literature say about this topic? Now this isn't a comprehensive review of the literature but I have chosen a few papers to guide our discussion. Now in this study published in Retina in 2007 from Hyoung Kuh and co-authors, prophylactic laser was performed for patients undergoing 20-gauge PPV for macular disease and they showed that prophylactic laser decreased the incidence of post-operative retinal detachment from 13.3% to 3.5%.

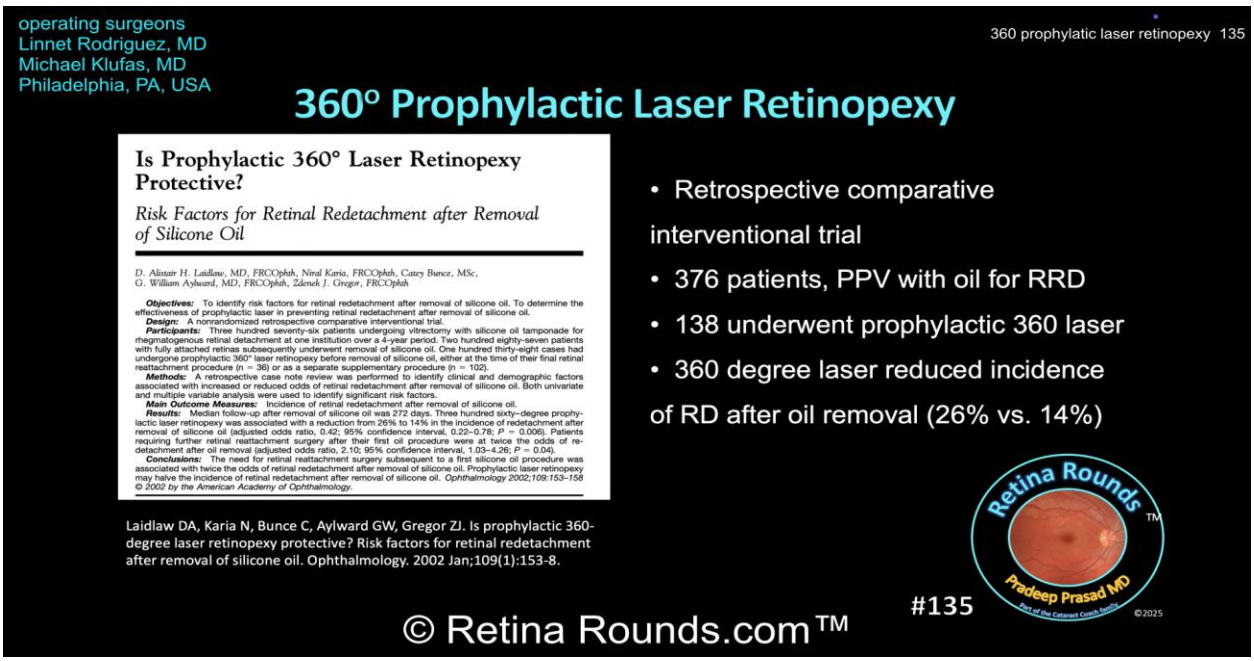


In this study by Takeshi and colleagues, prophylactic 360°laser was performed in patients undergoing again 20-gauge phacovitrectomy for either macular hole or retinal detachment. While there wasn't any protective effect shown in the retinal detachment cohort, 360° prophylactic laser did decrease the incidence of post-operative retinal detachment in the macular whole cohort from 5.7% to 0% at the 12-month postoperative period.

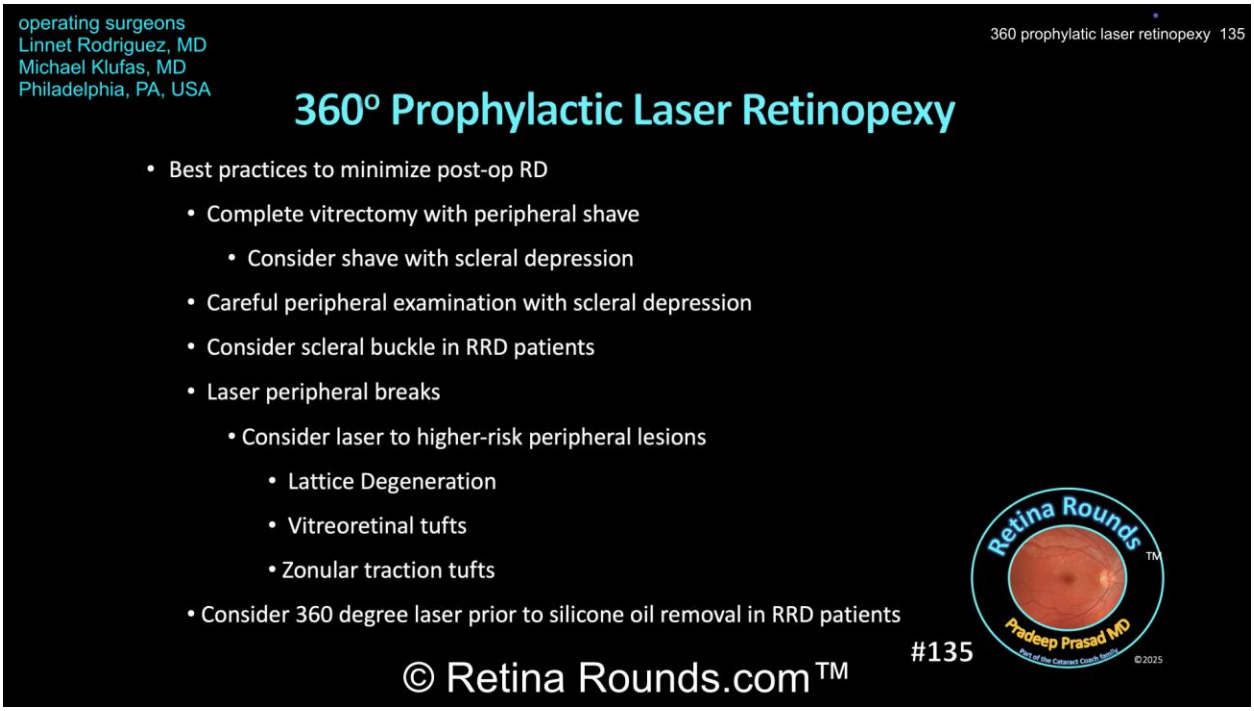


What about cases with small gauge surgery? Well, this study by Aakriti and co-authors published in Retina in 2018 looked at prophylactic 360° laser performed pre-operatively in patients who were undergoing vitrectomy for an ERM or macular hole and they found that this procedure did not decrease the rate of post-operative breaks or retinal detachment.

Now, how about patients who are undergoing vitrectomy for retinal detachment? Well, in two large retrospective studies, the Manchester pseudophakic retinal detachment study and the primary retinal detachment outcome study, 360° prophylactic laser did not improve the single surgery anatomic success rate and in fact was associated possibly with worse visual outcomes.



And last, what about eyes with silicone oil? Well, this paper from Alistair and colleagues showed that prophylactic laser decreased the incidence of retinal detachment after silicone oil removal from 26% to 14%.

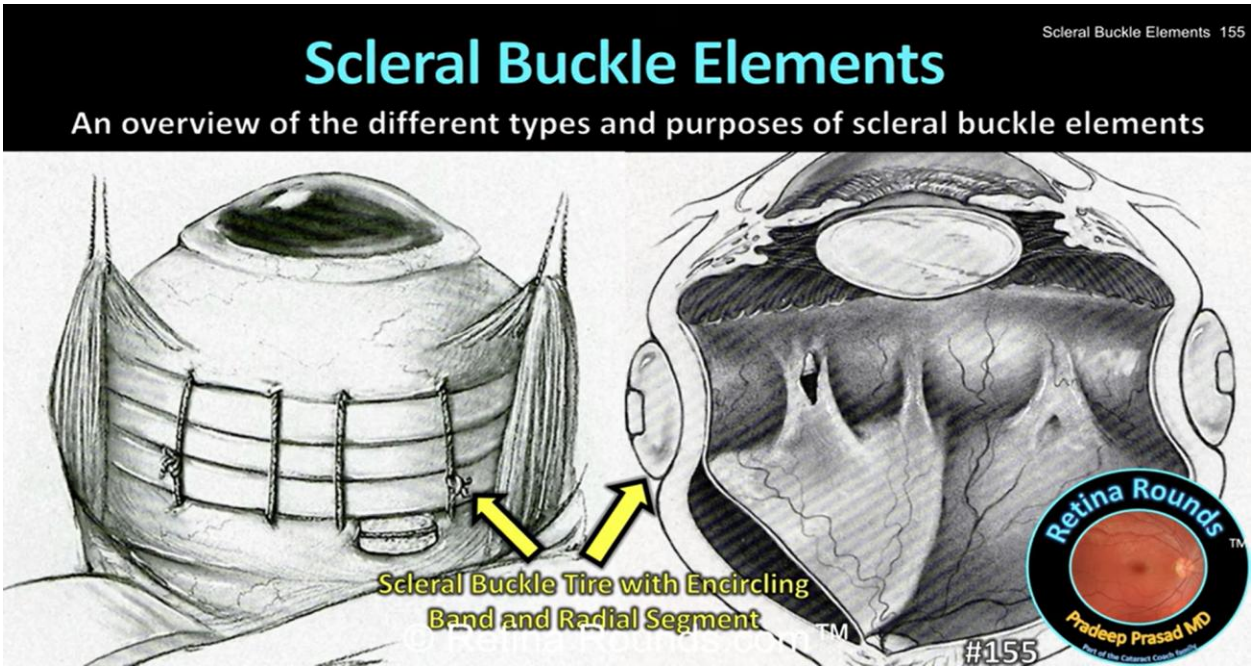


There are of course many more papers on the topic and I'd recommend the retina rounds community to take a look at these papers and others. So, how do we put all of this information together? Well, in the era of small gauge surgery, it's not entirely clear that prophylactic 360 laser is necessary to prevent a retinal detachment. So, what can we do to minimize postoperative retinal detachments? Well, some best practices include performing a thorough vitrectomy. While some surgeons don't routinely shave the vitreous base, I feel that peripheral shaving sometimes with the assistance of scleral depression, as was shown in Dr. Klufas case can decrease the risk of post-operative retinal breaks. Now, even if peripheral shaving is not performed, it's a good idea to routinely perform a scleral depression exam under wide field visualization to check for any peripheral retinal breaks or other pathology that may need to be treated with laser. Now, peripheral retinal breaks should be lasered and one can also consider lasering at risk lesions like lattice degeneration and vitreoretinal tufts. Now, while there's conflicting evidence as to whether or not routine 360° prophylactic laser is of benefit, I think it's reasonable to consider it in patients prior to silicone oil removal and possibly in other high-risk eyes like those with giant retinal tears.

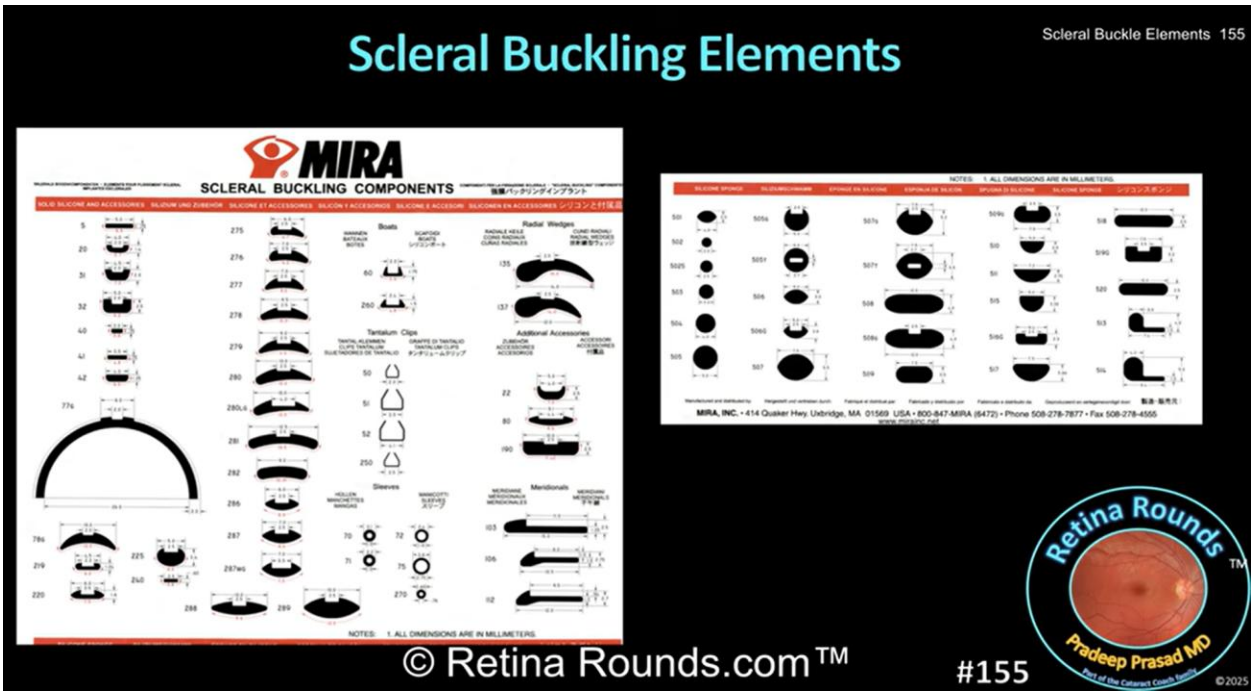
When performing peripheral laser, one should aim for about two to three rows of near confluent laser of medium intensity gray wide burns and that laser should be applied ideally at the posterior margin of the vitreous base although some consider also extending that laser up to the ora serrata. You should also consider sparing the 3:00 and 9:00 clock hour positions when performing 360° laser. Now to the retina rounds community, please let us know your thoughts on this topic in the comment section. And thank you again Dr. Klufas for sharing this case and for giving us all an opportunity to learn more about the role of 360° prophylactic laser.

- **Scleral Buckle Elements**

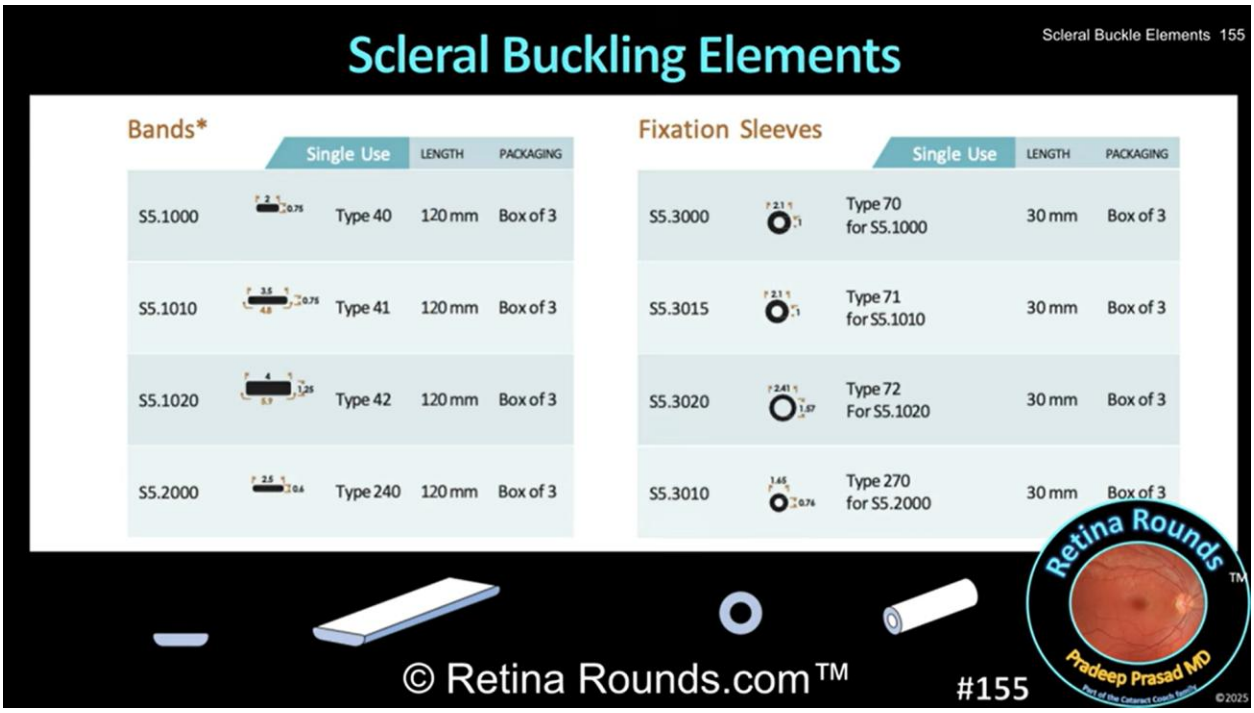
Link: https://www.youtube.com/watch?v=xrPn5IA75C4



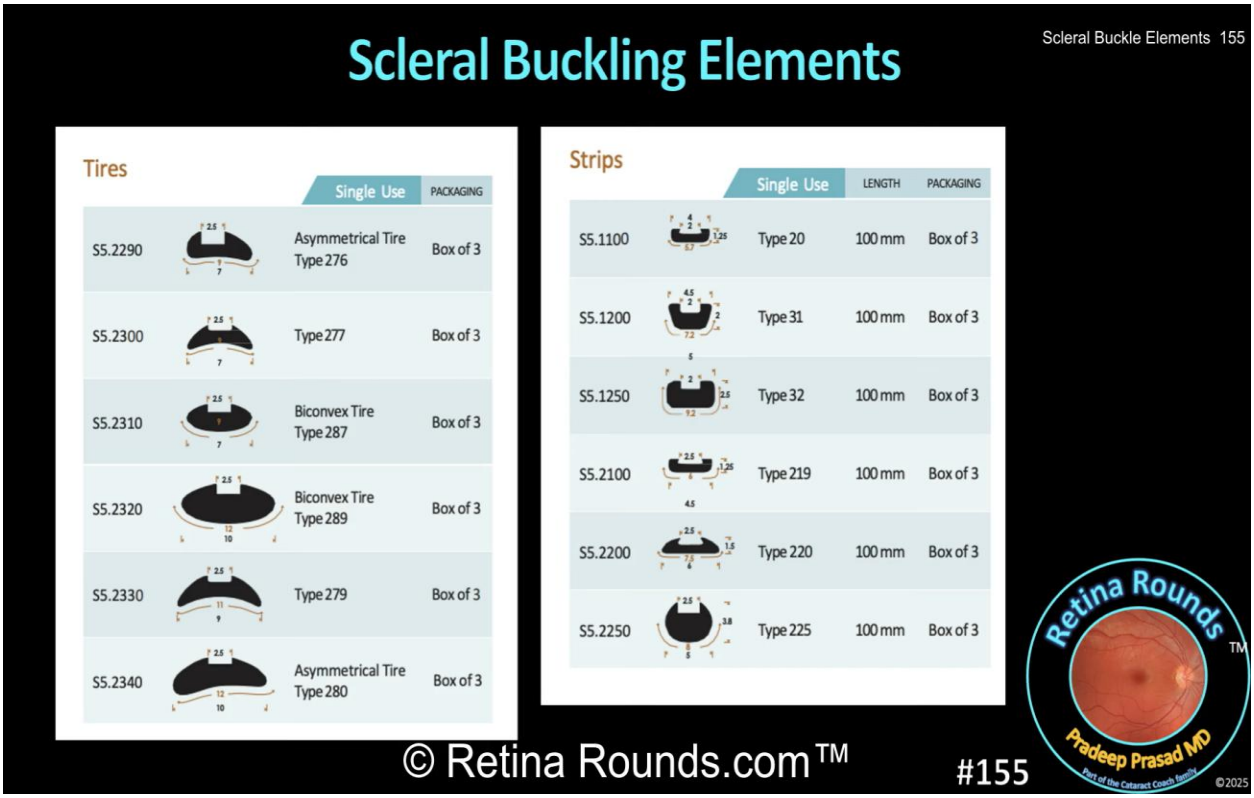
Scleral buckling is an incredibly valuable skill that every vitreoretinal surgeon should be familiar with. Our next series of videos will focus on various aspects of scleral buckling. Today we will discuss the different types and purposes of scleral buckle elements. The type of element chosen by the surgeon can have a significant impact on the success of the surgery. We hope this will be a valuable overview and at the end I will talk about the handful of go-to buckles I use in my own practice.



There are a variety of scleral buckle implant manufacturers, and most will provide a package insert listing all the different buckling elements that are available. This is the package insert from MIRA and you can see that there are many different options which can be overwhelming for trainee surgeons. Now, while there are many options, most surgeons will only use a few elements for the majority of their cases. However, the variety of shapes and sizes of scleral buckles provides many options for surgeons to choose a buckle that is appropriately suited to their patients' pathology.



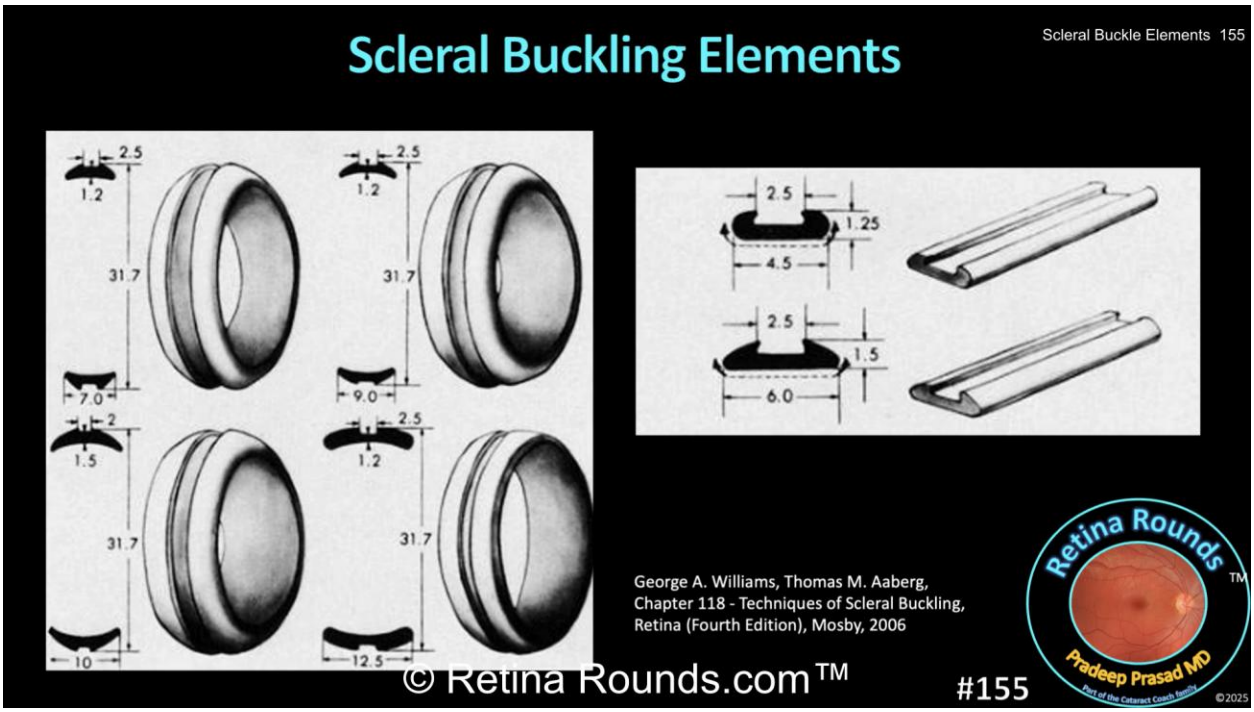
Buckle elements can generally be categorized as solid silicone implants and silicone sponge elements. As the names imply, solid silicone implants are not compressible while silicone sponge elements are. We'll discuss sponge elements a little bit later, but first let's talk about the different types of solid silicone implants. These are categorized based on their shape and function. The most common type of solid silicone scleral buckle is a band which is used to encircle the eye at the level of the vitreous base. The band is slipped under each of the rectus muscles and the two free ends are secured together typically in the superonasal quadrant where there are sufficiently redundant tenons and conjunctiva to cover the extra bulk where the two ends meet and overlap. Now the two ends of the band are usually held together by a fixation sleeve which looks like a hollow tube that can be cut to a narrower width so that the sleeve can bind together the two ends of the band. Now, bands come in a variety of sizes, but the most commonly used bands are the 41 band, which has a 3.5 mm width, and a 42 band, which is slightly wider at 4 mm. While an encircling band can be used as a primary scleral buckle element, it is more commonly used to support the vitreous base in cases of combined vitrectomy and scleral buckle. 40 and 240 bands are usually used in combination with grooved scleral buckles, which we'll get to next.



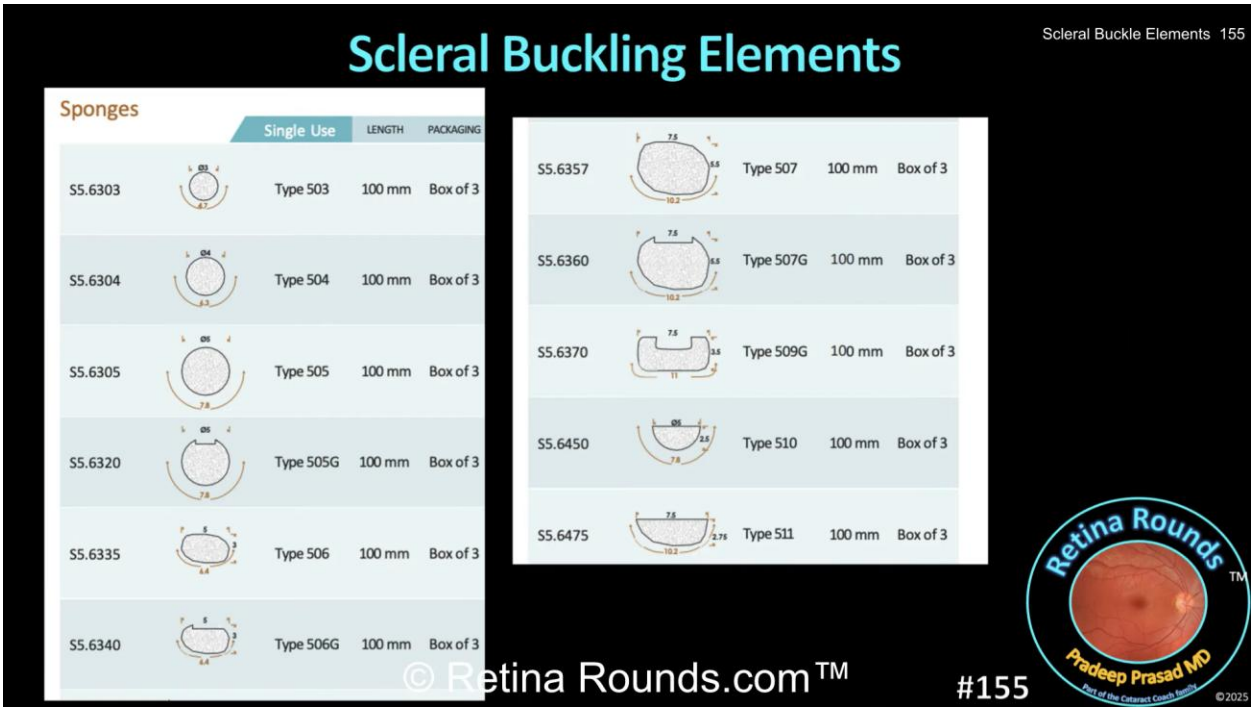
So, these are the two types of solid silicone grooved scleral buckles. To the left we have tires which are so named because the element comes not as a flat strip but as a circular continuous element that looks like a tire. The element needs to be cut to a length determined by the surgeon based on the number of quadrants where the element will be applied. You can see that tires are generally wider ranging from 7 to 12 mm in width. These wider elements allow for larger or more posterior breaks to be supported by the buckle. While the tire can be technically used to encircle the eye, typically it's used in one or two quadrants where retinal breaks are present. The groove in the element accommodates a smaller band like a 240 or 40 band to be placed in the groove with the smaller band encircling the eye holding everything in place and providing some support to the vitreous base in the remaining quadrants. The choice of the band that goes in the groove is determined by the size of the groove. For example, the 276 tire has a 2.5 mm wide groove which accommodates a 240 band of the same width. You will notice that the groove is sometimes symmetrically oriented in the middle of the tire and sometimes asymmetrically or oriented with the groove closer to one side than the other.

Generally, the groove in an asymmetric tire should be oriented more posteriorly so that the band in the groove gives the buckle extra elevation on the posterior extent, which is the so-called posterior kick. Now, strips are similar to tires except they're generally not as wide and come as a flat strip as opposed to a circular tire shape. Generally speaking, grooved tires and strips allow for the surgeon to use an encircling band with a broader or wider element used in specific areas of pathology. The wider the element, the wider the sutures need to be placed and potentially the more difficult it will be to place since posterior exposure and posterior suture placement can be

a challenge. So, limiting far posterior sutures to just those quadrants where it is necessary can make the scleral buckling procedure easier.

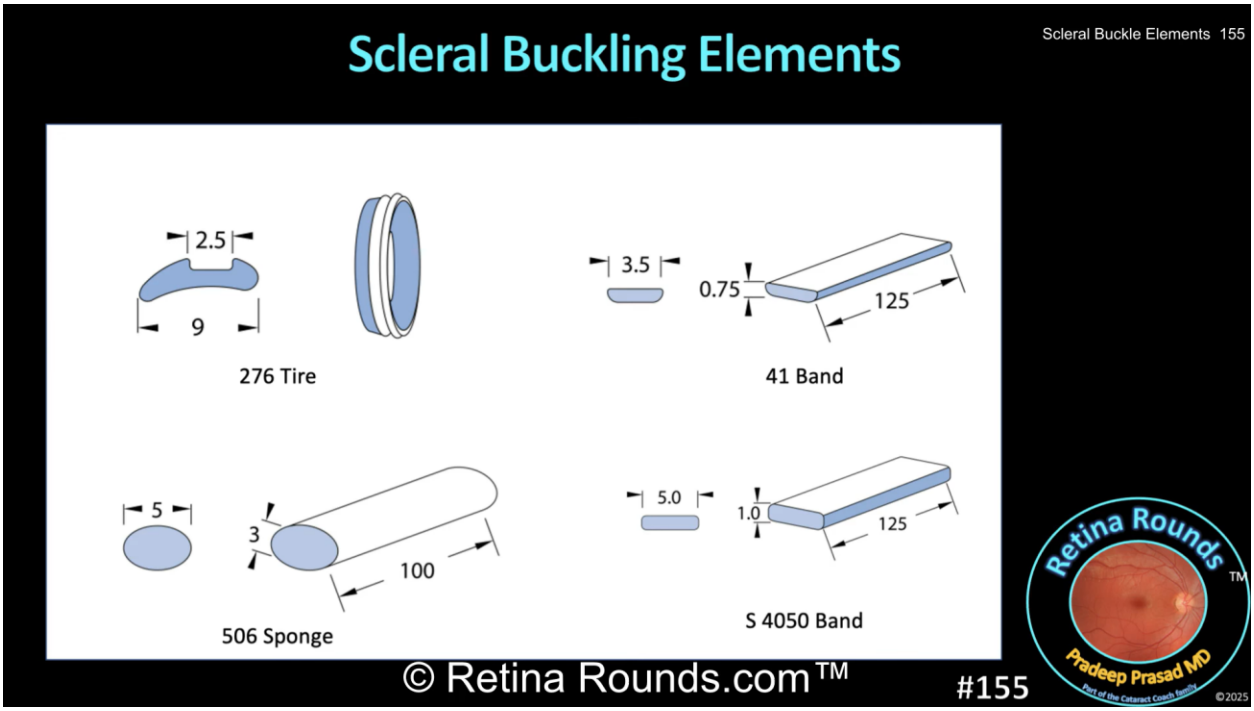


The image to the left demonstrates what a solid silicone grooved tire looks like, and the image to the right demonstrates what a solid silicone grooved strip looks like.



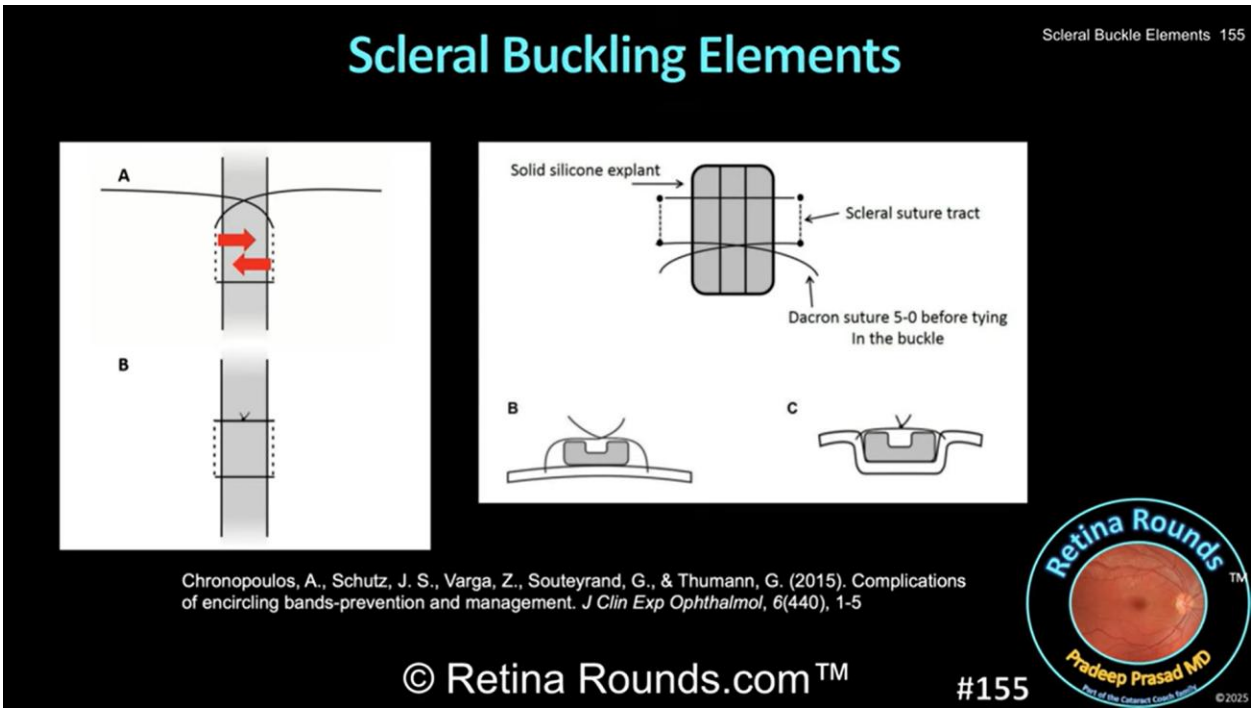
Last, we have silicone sponge elements. Some sponge elements have a groove for an encircling solid silicone band, while most do not. Sponge porous and compressible. The benefit of these elements is that the buckle height achieved can be adjusted based on the tightness of the sutures holding the element in place. So, sutures tied more tightly will result in a higher buckle contour in the eye while less tightly tied sutures will have a more low-lying contour. Now these elements are often used for radially oriented scleral buckles to reach more posterior pathology. Although they can also be placed in a circumferential orientation either in a segment or completely encircling the eye. Since these elements are porous, they may be more prone to infection.

As a side note most surgeons bathe buckling elements in an antibiotic solution prior to implantation to decrease the risk of bacterial seeding of the implant. It should be noted that modern silicone sponge elements are different than older hydrogel sponge implants, which were prone to infection and swelling over time, which could result in erosion through the overlying conjunctiva or even into the eye. Hydrogel sponges are notoriously difficult to remove on block since the material over time disintegrates when manipulated.



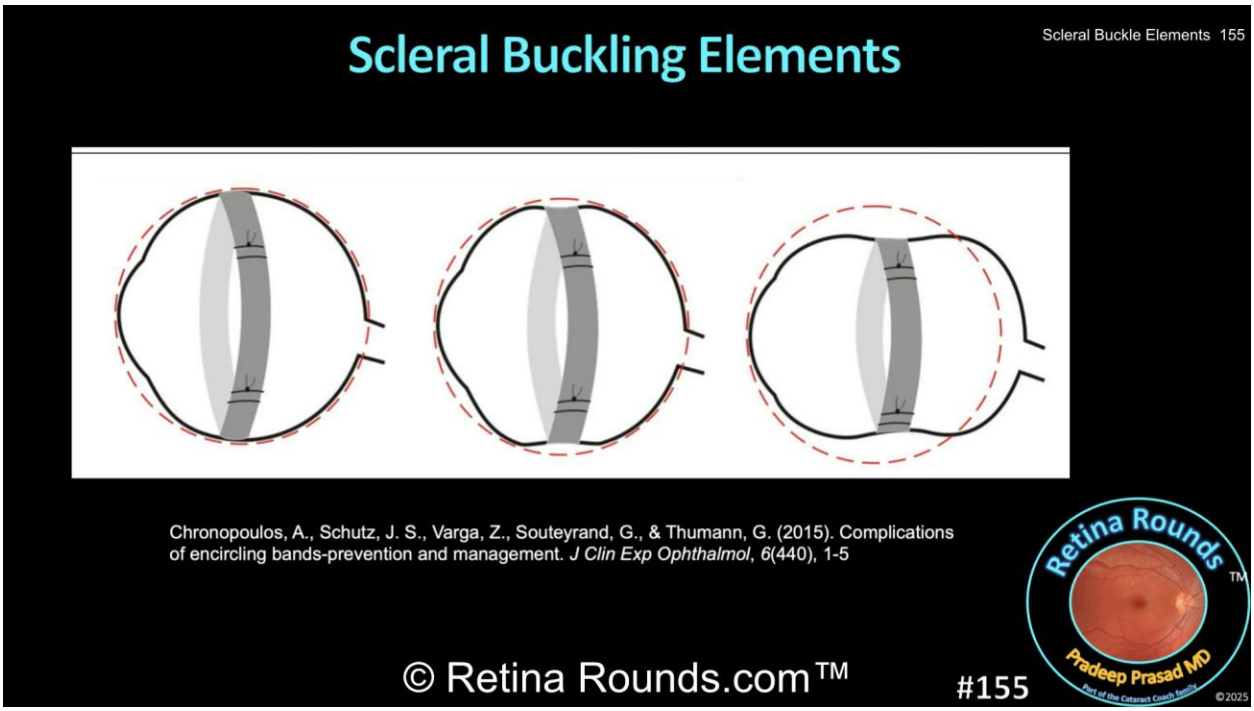
Now, you will notice on the package inserts that images are provided to indicate the shape and dimensions of the buckle element. These measurements can help the surgeon when deciding on the appropriate size of buckle to use, but they can also help to determine the appropriate spacing of the mattress sutures that will be used to secure the buckle in place. As an example, you'll see that the width of the S4050 band in the bottom right hand corner is 5 mm wide, while the height is 1 mm. Now to get the ideal buckle height, the mattress style sutures placed to hold this buckle in place should be placed 7 mm apart so that when the suture is tightened, the scleral conforms to the posterior surface and sides of the scleral buckle. This is what's

called **imbrication** which effectively is an anteroposterior shortening of the sclera with an indentation of support provided by the buckle element.



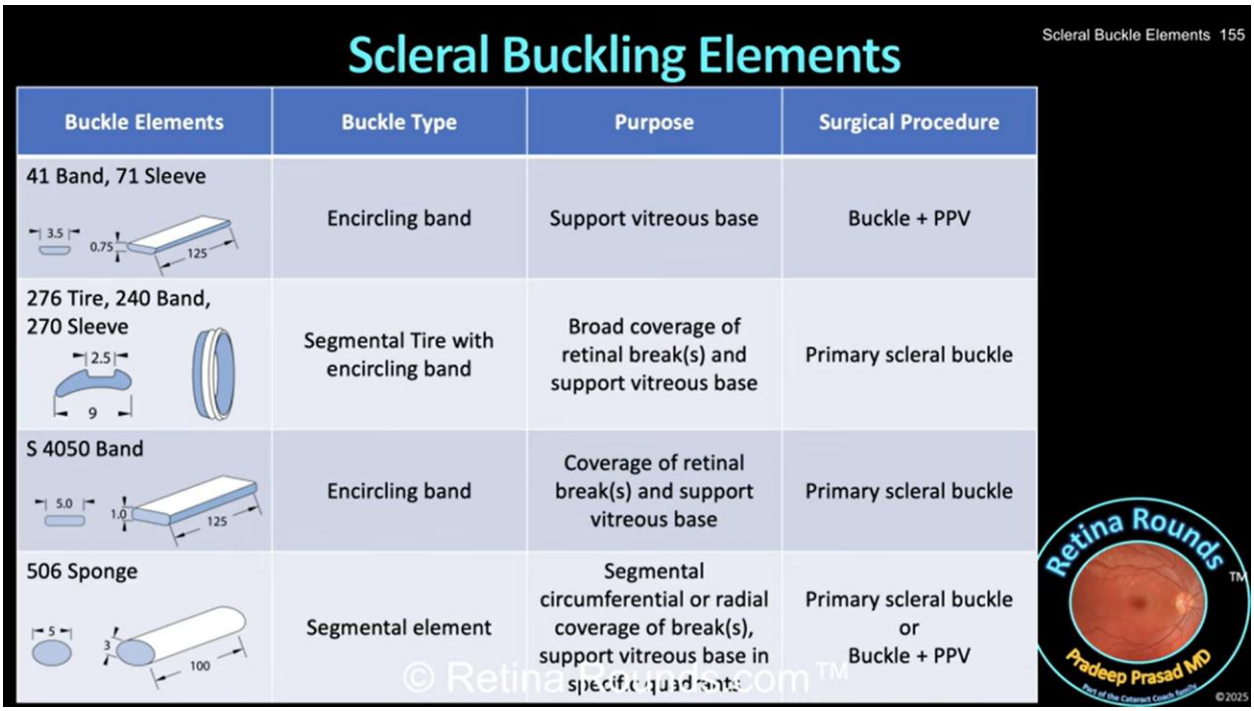
Now this concept can be a little confusing. So, let's have a look at a diagram of this from an outstanding paper on scleral buckling by Chronopoulos and colleagues from 2015. The diagram to the left shows how a mattress suture is placed to hold a buckle in place. In this case, a silicone band. The dotted lines indicate partial thickness scales with the suture. Depending on how widely spaced those partial thickness bites are will determine the imbricating or anteroposterior shortening effect of the sutures.

The image to the right shows the ideal amount of imbrication. You can see in images B and C that when the sutures are placed wider than the buckle element that tightening of the sutures results in a conformation of the sclera to the under surface of the buckle and the sides of the buckle. This is ideal and the sutures should not be tightened so much that the sclera overrides the outer surface of the buckle. Now going back to our example of the S4050 band, since the band is 5 mm wide and the sides are 1 mm high, the mattress suture should be placed 7 mm apart so that the scleral imbrication conforms to the posterior surface and the sides of the buckle.



Now there's one other important thing to note about buckle height. As we've discussed previously, buckle height can be achieved through imbricating sutures.

For encircling bands, buckle height can also be determined by how tight the encircling band is tightened around the circumference of the eye. Kind of like how tight you might wear a buckle around your waist to hold up your pants. Now to the left, you see an encircling buckle that is not sufficiently tightened since there is no buckle height. In the middle, you see the ideal amount of buckle tightening resulting in circumferential elevation without excessive elongation of the eye. To the right, you can see an encircling band that was tightened too much resulting in a high elevation of the buckle and excessive anteroposterior elongation of the eye. Now overtightening encircling band in this fashion can induce significant myopia and anisometropia. With practice visualizing the height of the buckle in the eye is the best way to determine if a buckle is not tight enough, just right or too tight.



Last, I thought I would share my go-to buckles. Now, these are buckle elements that I use in the vast majority of my cases. It should be noted, however, that these are just my preferences, and each surgeon will likely have their preferred buckle elements. And there is no right or wrong approach since many different buckle elements can be used successfully to repair a retinal detachment.

Probably the most common buckle I use is a 41 band with a 71 sleeve. And if a 71 sleeve is not available, either a 70 or 72 sleeve can be used instead. The 41 band is an encircling band with a 3.5 mm width. I use it in combined vitrectomy buckle cases to support the vitreous base. In some cases, I may upsize to a 42 band and a 72 sleeve, which is slightly wider in patients with a wider vitreous base.

For primary buckles, my most common elements are the 276 tire with a 240 encircling band and a 270 sleeve. Now, the 276 tire is one of the most forgiving scleral buckles that you can use. Since it's 7 mm wide, I can be confident that larger breaks or even breaks that extend more posteriorly will be well covered by the buckle. Now, I'll usually place the 276 tire in one or two quadrants to cover the retinal breaks. With the smaller encircling 240 band also providing some support to the vitreous space in the other quadrants.

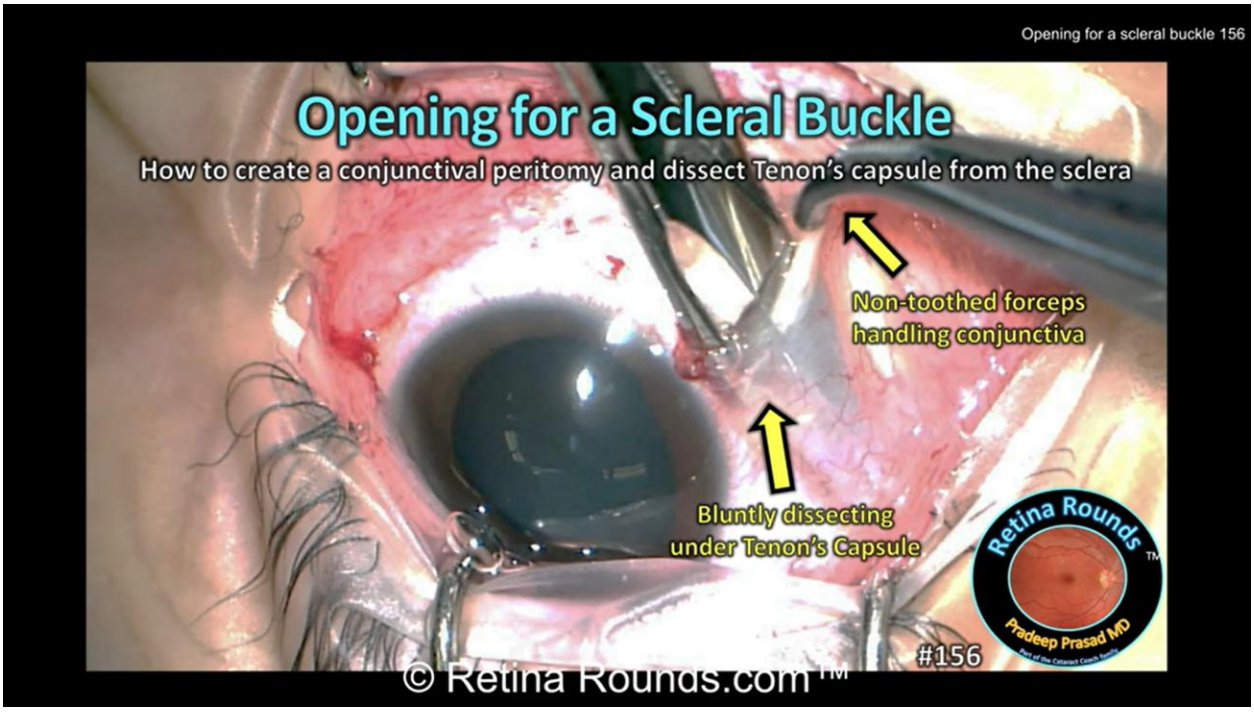
In some patients, retinal breaks and other pathology may be present in three or four quadrants. While a 276 can be used, it can be laborious to place such a wide element in multiple quadrants. In this scenario, I like to use the S0450 band. It functions just like an encircling band, but it is wider than a 41 or 42 band, allowing for better coverage of potentially posterior extending breaks.

Last is the 506 sponge, which I typically use if I want to perform a segmental scleral buckle. And that's to say, I want to have a buckling effect in one or two quadrants without the encircling effect.

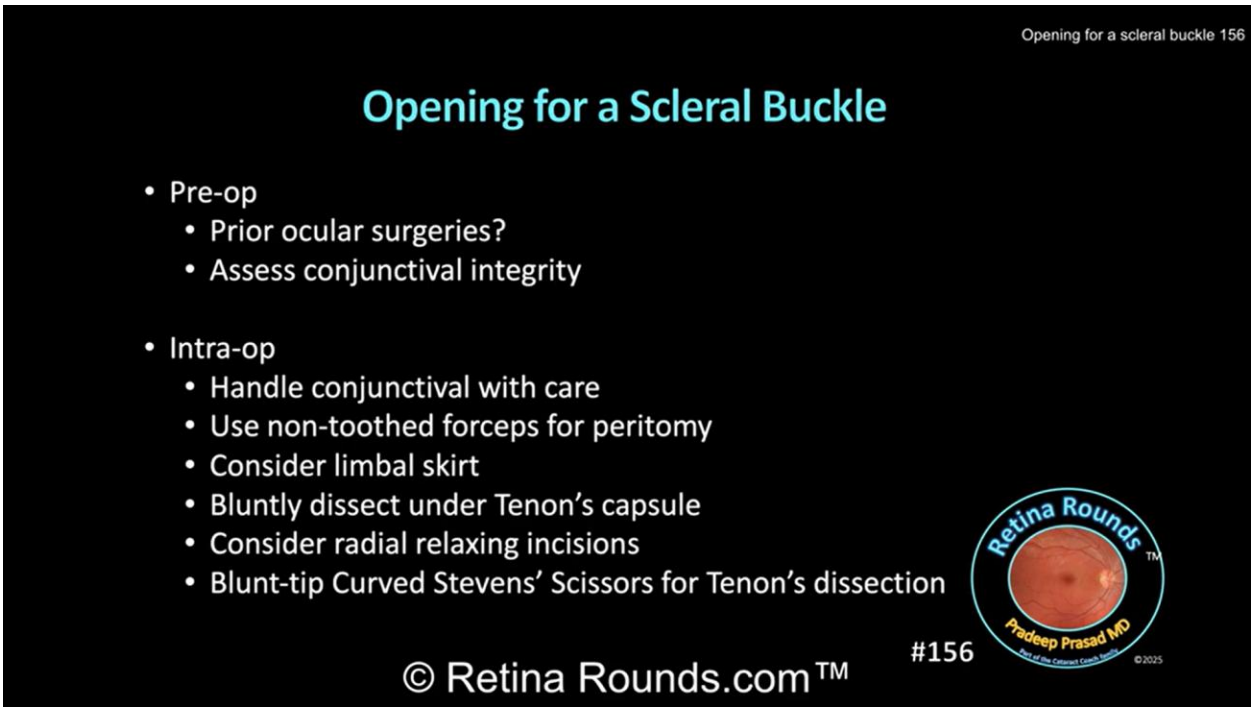
This can be more efficient in retinal detachments caused by a single break since the buckle can just be placed in the quadrant where the pathology is located. The buckle can be oriented circumferentially and tucked under the adjacent rectus muscles or it can be placed in a radial fashion directly over the break. The 506 sponge can also be placed circumferentially over multiple quadrants to support the vitreous base. In some cases where a combined vitrectomy buckle is the best surgical treatment of a retinal detachment, the presence of a trabeculectomy or filtration device may preclude placing a 360° buckle. In these scenarios, when support of the vitreous space is desired, placing a circumferential 506 sponge in the remaining quadrants can work quite well. Now, we've covered quite a lot in this episode and you may still have questions or need clarification. Please feel free to ask questions in the comment section and in the coming episodes, we'll show you examples of each of these buckles. We hope this was helpful and thanks so much for watching.

- **Opening for a Scleral Buckle**

Link: https://www.youtube.com/watch?v=6cTZhnpT9uU&t=2s



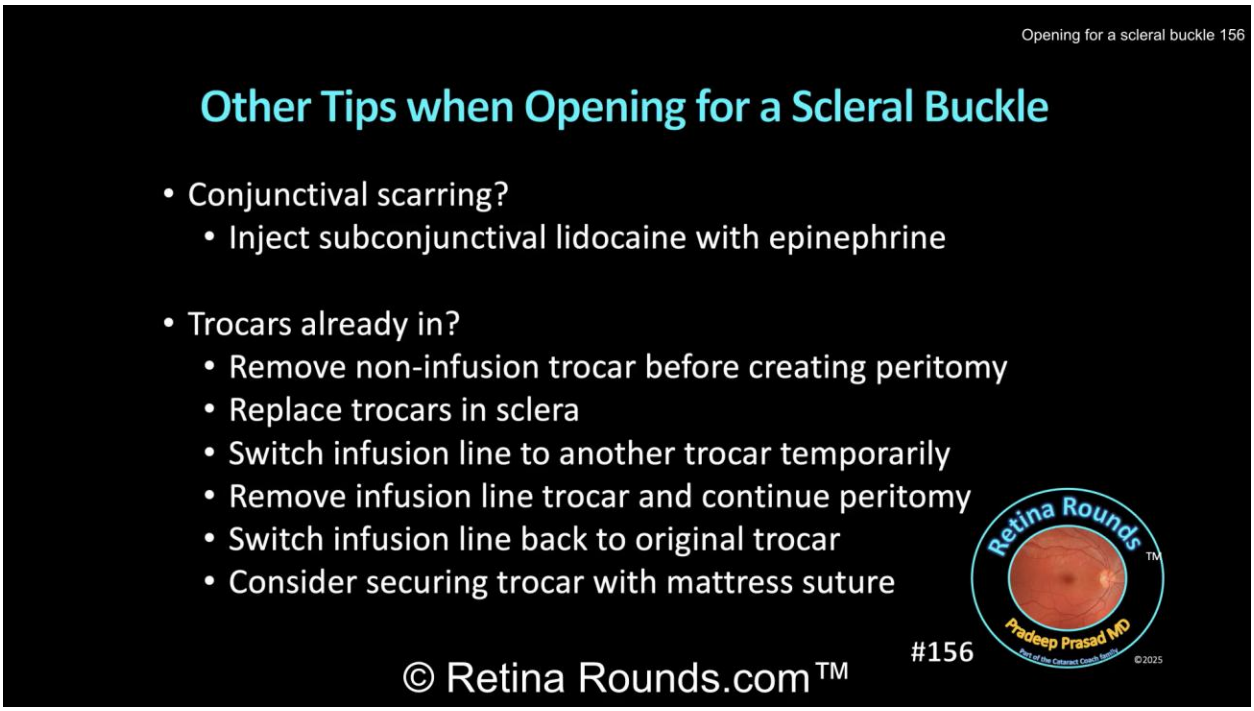
In today's episode we will be reviewing basic techniques for creating a conjunctival peritomy and dissecting Tenon's capsule from the scleral surface when performing a scleral buckle. For trainee surgeons, this may be one of the first steps you will be asked to perform when assisting for a scleral buckle. We will discuss fundamentals for routine cases as well as tips for opening when an eye has had prior surgery, significant conjunctival scarring and when adding a scleral buckle during a vitrectomy when trocars are already in place.



So here are some points for discussion.

Prior to performing a scleral buckle, it's important to know whether the patient has had any prior ocular surgeries and in particular prior ocular surgeries that involve the conjunctiva and this could include a prior trabeculectomy, tube shunt implantation, strabismus surgery, and open global repair, and this may influence the extent of the peritomy and these prior surgeries may result in conjunctival scarring that could require special care when handling and dissecting the conjunctival tissue even in patients without prior ocular surgery, it's important to assess the conjunctival so that you can be well prepared during the surgery.

Intraoperatively, one should always handle the conjunctiva with care. Tearing or shredding of the conjunctiva during opening can make closure very difficult and can compromise conjunctival integrity if future surgery involving the conjunctiva is required. The use of non-to forceps such as dressing forceps can minimize conjunctival trauma. When opening one should consider leaving a 1 to 2-millimeter conjunctival skirt at the limbus as this can preserve limbal stem cells and can decrease the risk of conjunctivalization of the cornea also the limbal skirt is also a good spot to anchor the conjunctiva during closure thereby preventing conjunctival overhang and poor post-operative cosmesis. When extending the conjunctival peritomy be sure to bluntly dissect under tenon's capsule since preserving tenon's capsule can also ensure good closure at the end of the case. Consider creating a radial relaxing incision at the time of peritomy creation. This can decrease the chance for uncontrolled conjunctival tearing and can facilitate better closure at the end of the case. And last, when dissecting tenons away from the scleral surface, use a blunt tipped curved Steven scissor to prevent inadvertent conjunctival or scleral laceration.



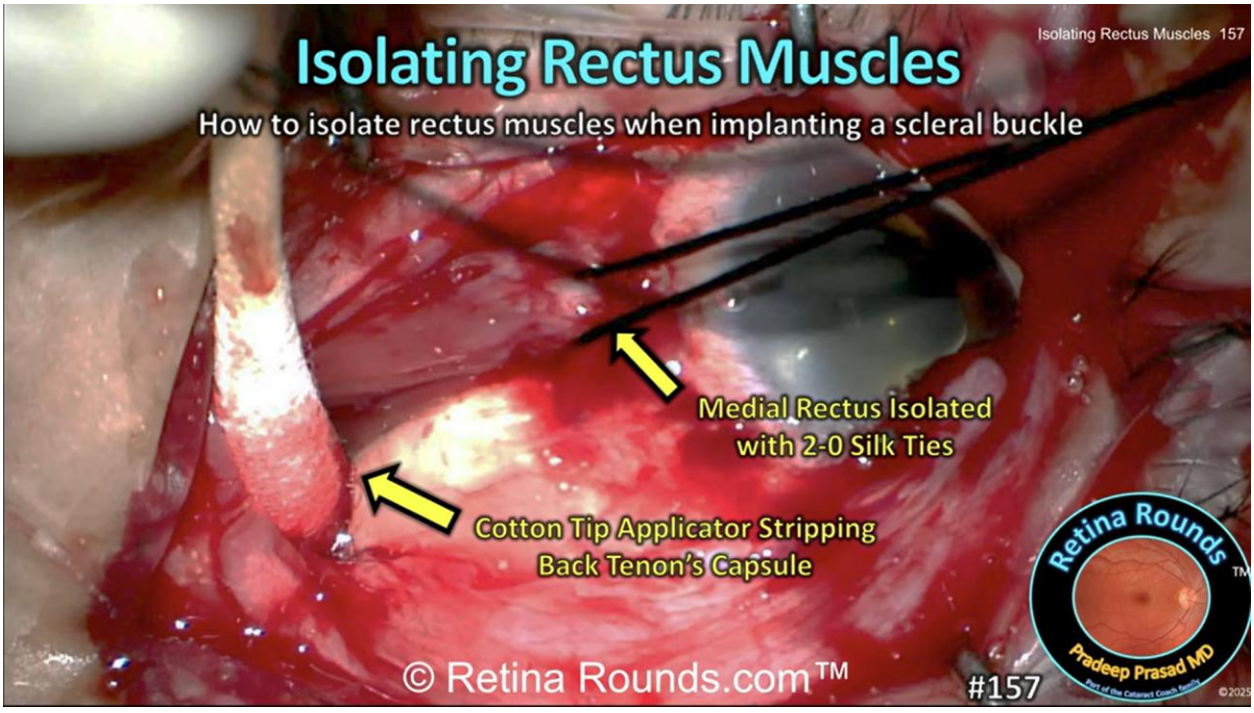
Now, here are some tips for special cases. If there is significant conjunctival scarring, the conjunctiva may shred during dissection and there can be significant bleeding as well. So, injecting a little bit of subconjunctival lidocaine with epinephrine can help to elevate the conjunctiva away from the sclera and can help to decrease bleeding.

If you're performing a vitrectomy and then you decide to add a scleral buckle, opening the conjunctiva can still be performed in an atraumatic fashion. So, for the non-infusion line trocars, those are typically the superonasal and superotemporal trocars. The trocars can be temporarily removed during the peritomy creation and then replaced after the peritomy is complete. Decreasing the infusion pressure during this step to about 10 to 15 mmHg can help to decrease the conjunctival ballooning when the trocar is removed since there will be egress of BSS from the vitreous cavity through the sclerotomy or the trocar with the infusion line, you can simply temporarily turn off the infusion and switch the infusion line to another trocar. Then you can turn the infusion back on. Now that trocar that was being used for the infusion line can be removed in the same fashion, and the peritomy can be extended. Once that peritomy is complete, then the trocar and the infusion line can be returned to their original location. Now when doing this sometimes the trocar can be more prone to slipping out of the sclera later on in the case and the use of a mattress style suture around the sclerotomy and trocar to anchor that trocar in place can be helpful to prevent the trocar from slipping out.

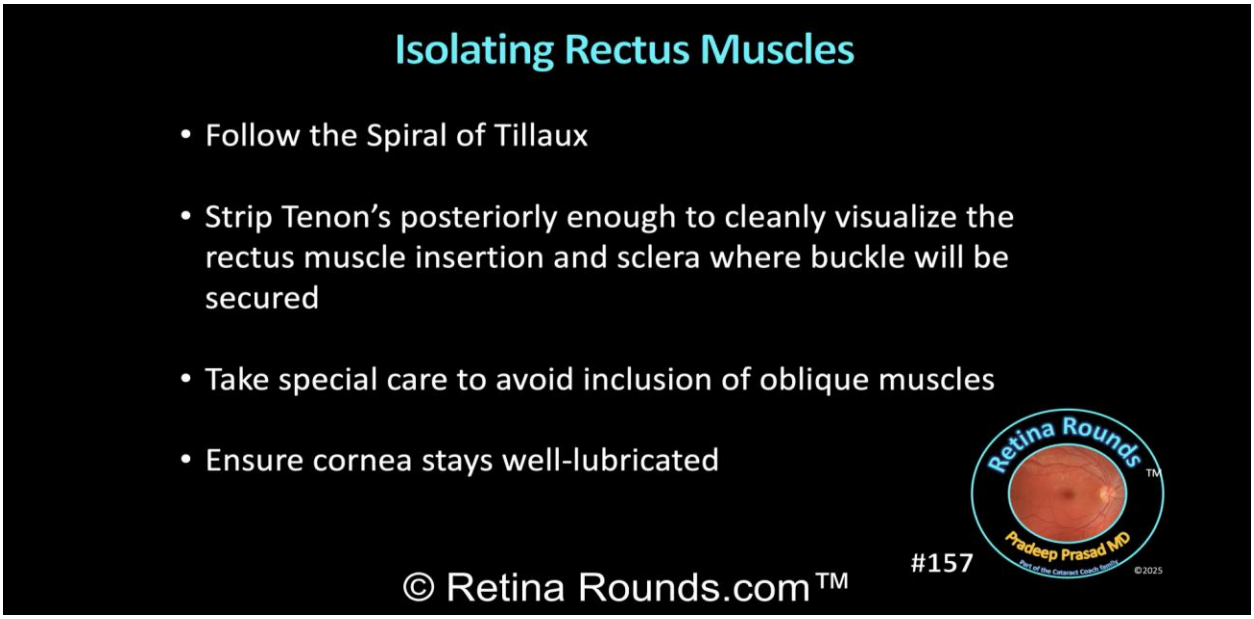
In summary, using good fundamental techniques when opening for a buckle is important to ensure good closure at the end of the case and to prevent issues should additional conjunctival based surgery become necessary. We hope this review was helpful and thanks so much for watching.

Isolating Rectus Muscles

Link: https://www.youtube.com/watch?v=1pChz8mzqck



Continuing our series on how to perform scleral buckles, our next step is to isolate the rectus muscles. Whether performing a primary buckle or a combination buckle and vitrectomy, here we will discuss some tips to decrease the risk of post-operative diplopia and to ensure adequate visualization of the sclera for buckle implantation. While rectus muscle isolation is a seemingly simple step during buckle implantation, it's important to get this early step done properly to set yourself up for success for the rest of the surgery and for the patient's post-operative recovery.



Here's some take-home points. As we showed you in the surgical video for ease it's a good idea to isolate the rectus muscles in order from anterior to posterior insertion following the spiral of Tillaux. **This means that the medial rectus muscle is isolated first followed by the inferior rectus then the lateral rectus and finally the superior rectus**.

You want to strip back tenon's capsule so that you have clear visualization of the entire length of the rectus muscle insertion. This is going to help to ensure that you haven't inadvertently split the rectus muscle. However, you also want to strip back tenons over the muscle and also in the quadrants where the buckle will be placed so that tissue does not interfere with your ability to cleanly secure the buckle to the scleral surface. Tenons capsule can get entangled in the buckle. It can fibrose and that can result in a restrictive strabismus.

By the same token you don't want to be too aggressive in stripping back tenons. Don't go too far posteriorly over the rectus muscle since the pulley system is located roughly at the level of the equator and disruption of the tenons in this location may put the patient at risk for post-operative ocular motility disturbance from pulley disruption.

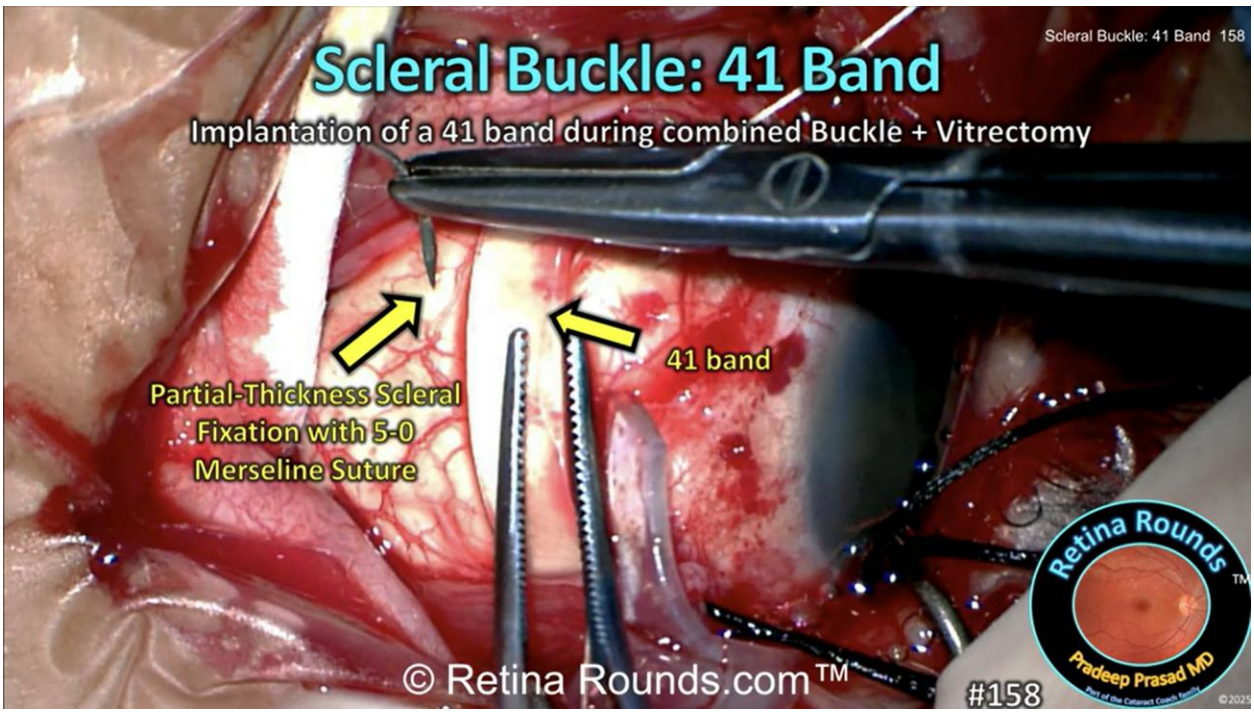
As we showed you in episode 61, you want to make sure not to engage the oblique muscles when isolating the rectus muscles. This can occur with the superior oblique when you're isolating the superior rectus muscle and potentially the inferior oblique when you're isolating the lateral rectus muscle. And again, clear visualization of the full length of the rectus muscle insertion point on the sclera can help you to ensure that the obliques have not been in inadvertently engaged.

Last, you want to make sure to repeatedly lubricate the cornea. Now, my preference is to use a highly dispersive viscoelastic agent and to reapply this frequently. The silk ties can rub against the cornea during rectus muscle isolation and while securing the scleral buckle. If the cornea is dry, the ties rubbing on the cornea may cause a corneal abrasion and that can interfere with the view to the posterior segment. Now, while isolating rectus muscles is a seemingly simple step during scleral buckle implantation, it's important to get this early step done properly to set yourself up for success for the rest of the surgery and for the patient's post-operative recovery.

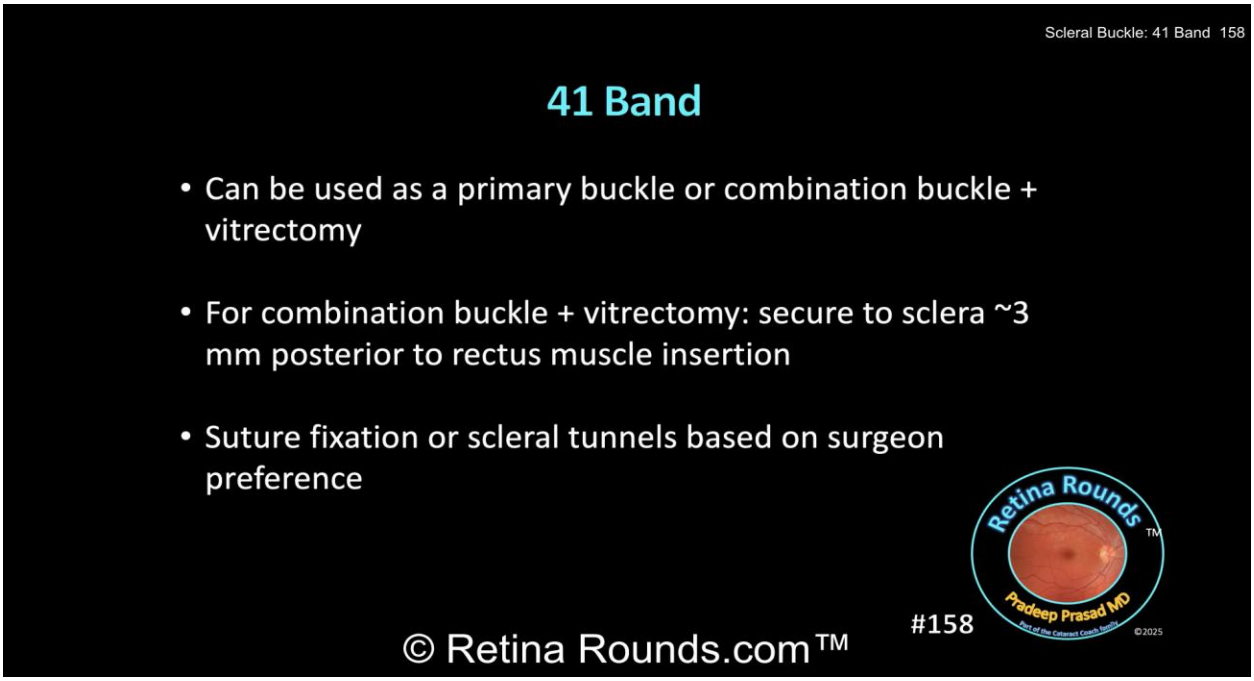
Thanks so much for watching.

- **Scleral Buckle - 41 band**

Link: https://www.youtube.com/watch?v=BdQjzZQJ9yQ

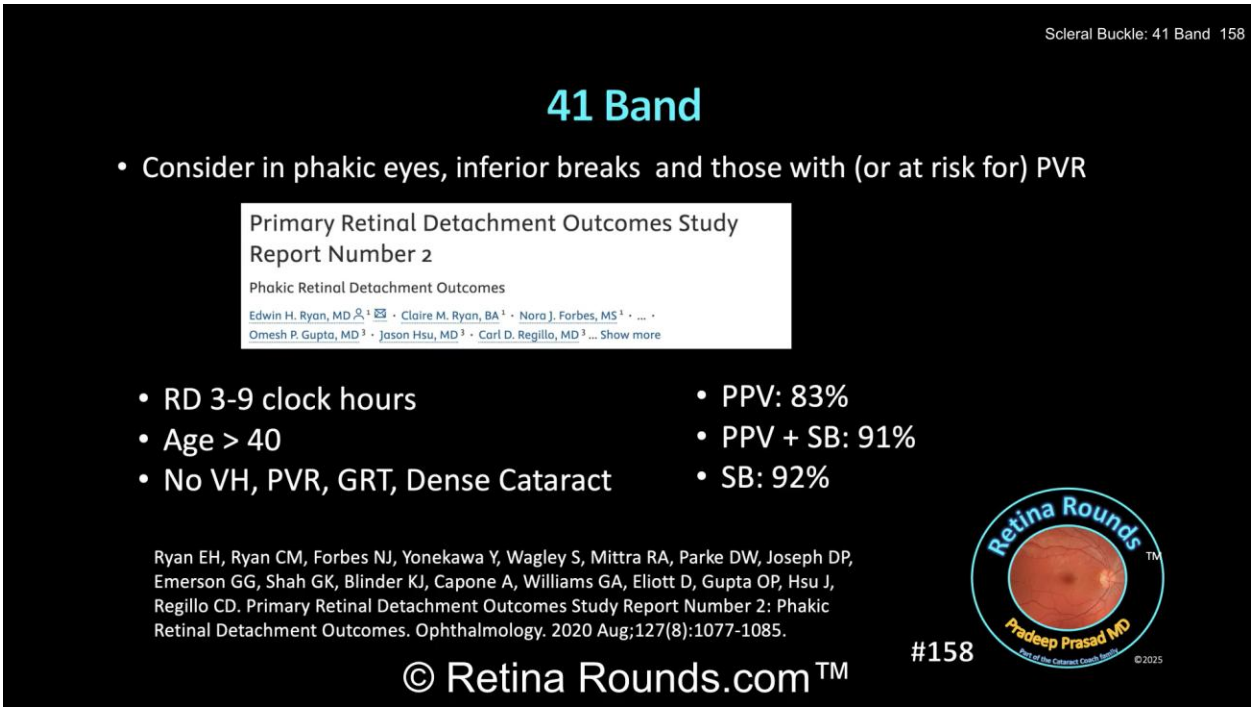


Continuing our series on scleral buckles, today we will show you how to implant a 41 band. The patient in today's video is undergoing a combined vitrectomy and scleral buckle and the 41 band has been chosen as the buckle element. We will show you all the steps for implantation and at the end we will discuss some of the evidence supporting the addition of a buckle with vitrectomy in select patients.



Here are some take-home points. The 41 band measures 3.5 millimeters in width and can be used either as a primary buckle or in combination with vitrectomy. When performing a combined vitrectomy and scleral buckle, I often will use the 41 band since it's wide enough to nicely support the vitreous base which is really the purpose of adding the band but narrow enough that is easy to work with and anchor in place but there are other types of bands that can be used depending on the surgeon preference. Now when using the 41 band in combination with the vitrectomy again the purpose is to support the vitreous base and to get the band in the desired anatomic position. Ideally it should be anchored with the anterior edge about **3 mm posterior to the rectus muscle insertion**.

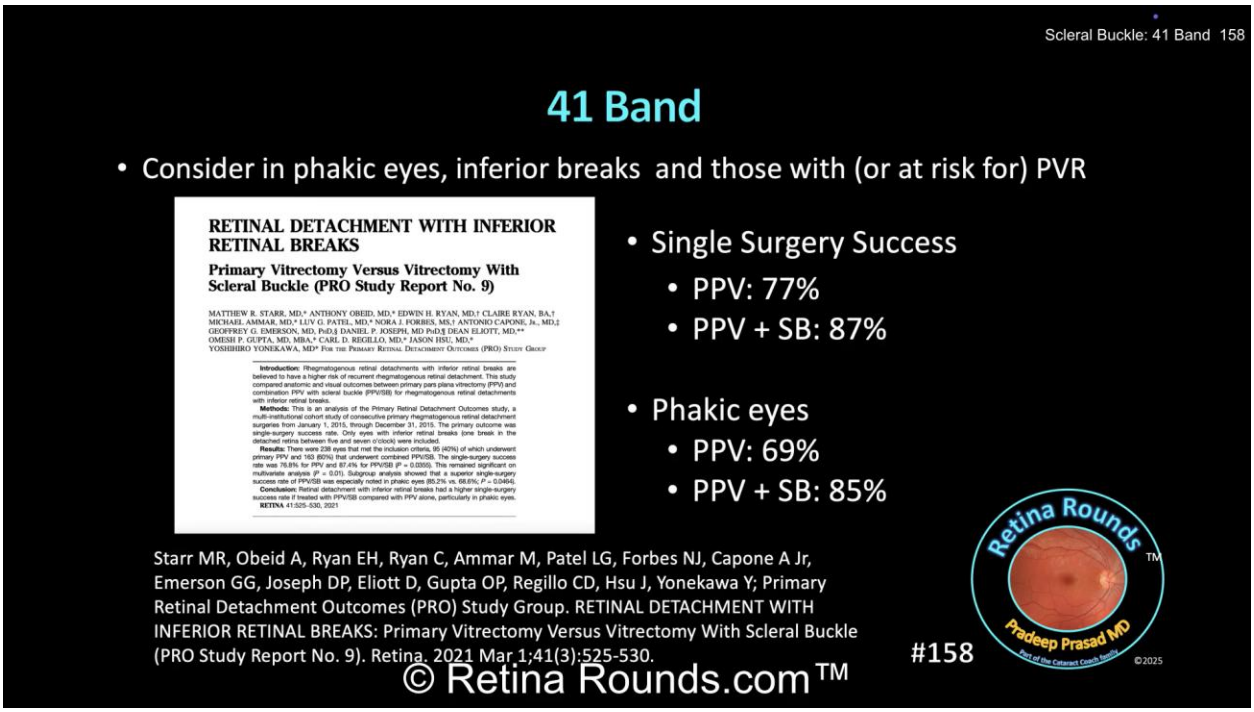
Securing the band to the scleral surface can either be done with partial thickness scleral tunnels through which the band is fed or with suture fixation. The choice is really dependent on surgeon preference with some surgeons preferring the tunnel approach since it can be easily done without an assistant. This technique however is not easily performed in patients with severe scleral thinning and carry with it the risk of inadvertent deep incision into the choroid and secondary choroidal hemorrhage. If the suture technique is employed as was shown in this video, a non-absorbable suture like mersilene or nylon should be used. The spatulated needle is flatter with a side cutting action making precise partial thickness scleral passes easier although scleral perforation still remains a risk. To avoid scleral perforation, the needle should always be visualized throughout the partial thickness scleral pass. As shown in the video, a mattress style suture fixation provides the greatest stability to anchor the band. The knots should always be rotated posteriorly to decrease the risk of overlying conjunctival erosion.



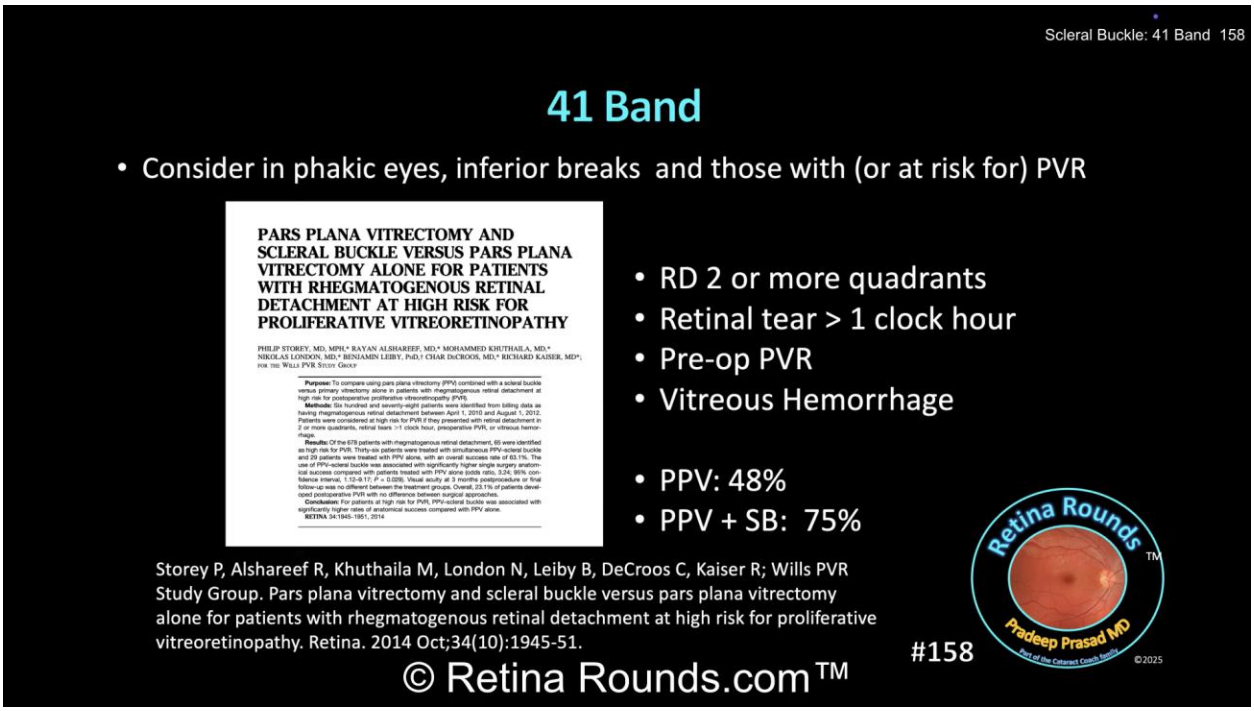
Now, there are some surgeons who almost never add a buckle when performing a vitrectomy. However, I would strongly advocate for having a low threshold to add a buckle, especially for certain patients. Most surgeons will tell you that they will they never regret adding a scleral buckle

but sometimes they regret not placing it at the time of the vitrectomy. The patients for whom you may want to add a scleral buckle when performing a vitrectomy include phakic patients, those with inferior breaks and those who have or are at risk for PVR.

Now with respect to phakic eyes, I would highly recommend reviewing the primary retinal detachment outcome study or PRO study report number two by Ryan and colleagues. This report included patients with moderately complex retinal detachments which were defined as eyes with a retinal detachment spanning 3 to nine clock hours. They excluded patients under the age of 40 for whom scleral buckling may be a preferred technique and patients with a vitreous hemorrhage, PVR, GRT or dense cataract for whom a vitrectomy or phacovitrectomy may be preferred. They showed a single surgery anatomic success rate of 83% for vitrectomy alone, 91% for buckle with vitrectomy and 92% for buckle alone. Now we'll show you more videos on primary buckling in the coming week. But if a vitrectomy is being performed on a phakic patient, this study supports the addition of a band and the improved outcomes are likely due to limitations in close shaving of the vitreous base in the presence of a crystalline lens.



Now how about patients with inferior breaks? Again, we'll look to the PRO study, this time, report number nine by Matt Starr and colleagues, patients in this report had a break in detached retina between the 5:00 to 7:00 clock hours. The single surgery anatomic success rate regardless of lens status was 77% for vitrectomy alone versus 87% for vitrectomy plus scleral buckle. The difference was magnified in phakic eyes with a single surgery anatomic success rate of 69% for primary vitrectomy versus 85% for vitrectomy with buckle.

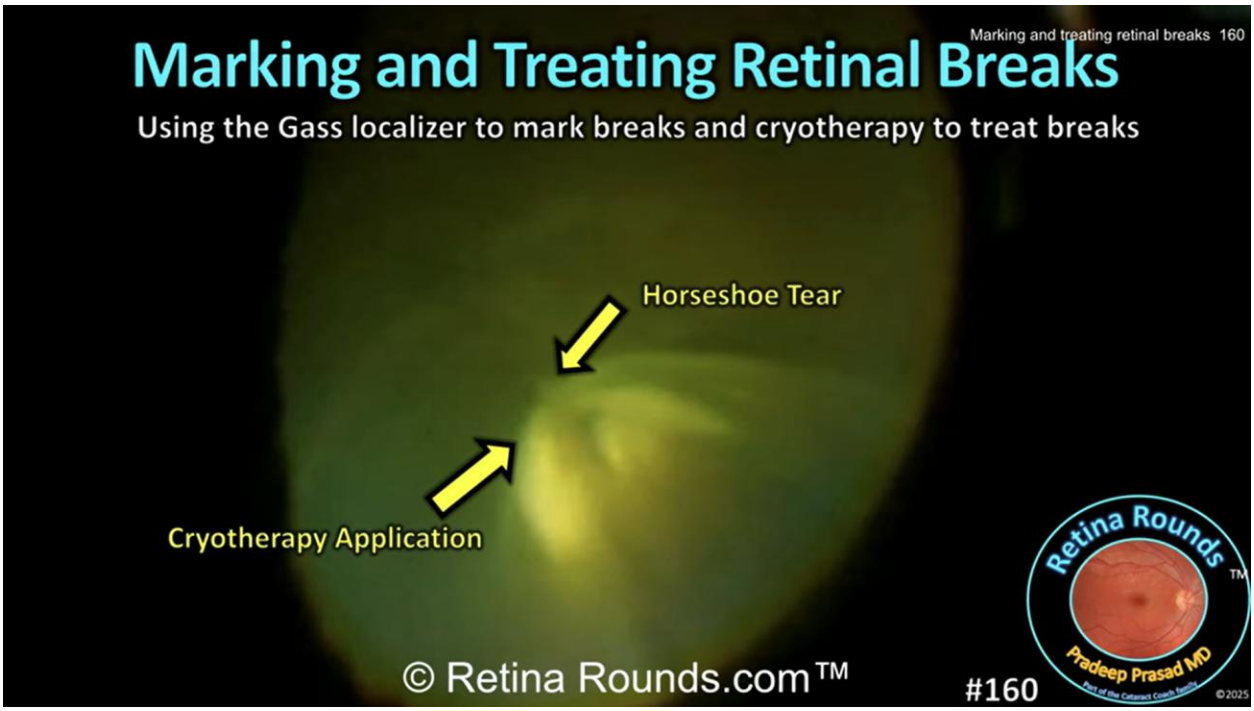


Now we know that buckles can be helpful to improve surgical success in patients with PVR. But what about patients at risk for PVR? In this study by uh Philip Storey and colleagues, patients at risk for PVR included those with retinal detachments in two or more quadrants, a retinal tear greater than one clock hour, pre-operative PVR, and patients with a vitreous hemorrhage. In this study, the single surgery anatomic success rate was 48% for vitrectomy alone versus 75% for buckle with vitrectomy.

Well, we hope you found this review of 41 band implantation to be helpful. For patients undergoing buckle and vitrectomy again there are a number of bands that can work including a 42 band and a 240 band. Ultimately, the choice of the buckle element will be based on surgeon preference. But regardless of the buckle element, the literature shows that the addition of a band in select patients can yield significant improvements in single surgery success. Thanks for watching.

- **Marking and Treating Retinal Breaks**

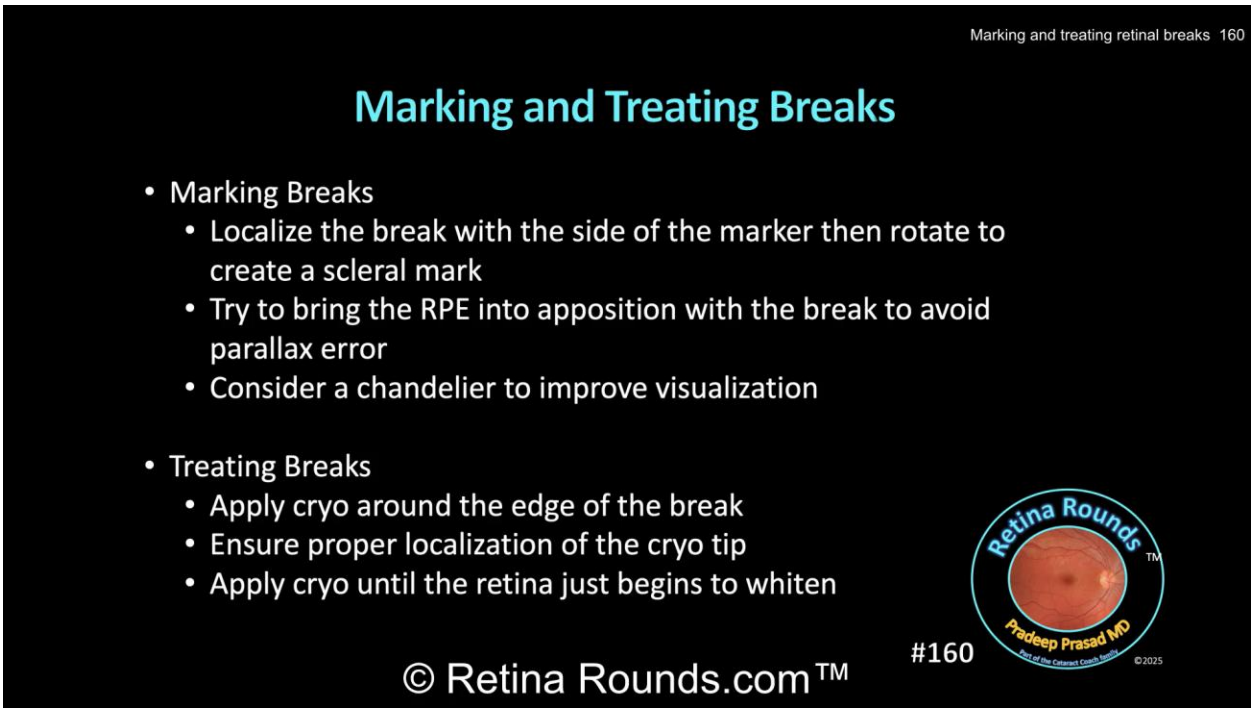
Link: https://www.youtube.com/watch?v=SAO1p0EKo9Q



Once the conjunctival peritomy has been performed and the rectus muscles are isolated, the next step in primary scleral buckling is to mark and treat the retinal breaks. This is a critical step and the surgeon needs to be meticulous in identifying, marking, and treating all retinal breaks. In today's episode we will review the key steps and provide some tips for success.

When marking retinal breaks, most surgeons use an O'Connor scleral depressor/marker, which is shown here to the left. One end, you can see, is smooth and rounded and can be used as a

scleral depressor. The other end has a Gass localizer, which is an open cylindrical projection shown in higher magnification below. When indented against the sclera, this side will make a temporary circular mark, which can then be further marked with a marking pen. The cryo machine and probe are shown to the right. The cryop probe can be curved or straight depending on the surgeon's preference. Typically, nitrous oxide gas is used with the cryo machine and the surgeon should make sure that the nitrous tank is full and the probe is operational before the start of the surgery.



Okay, so here's a review of some of the take-home points as well as some additional tips.

The Gass localizer should be used with care especially in eyes with significant scleral thinning to avoid potential perforation. Typically, the side of the Gass localizer which is smooth is used to indent the sclera to visualize the location of the retinal break and then that device is rotated so that the circular end is opposed to the sclera to make a mark. A few seconds of indentation is usually sufficient to make a scleral mark. One should take care to avoid any tenons or rectus muscles from coming in between the localizer and the sclera which can prevent adequate marking of the sclera.

When using an indirect ophthalmoscope to visualize the break and the localizer indentation, one should be aware of the potential for parallax error which can occur especially in bullous retinal detachments. So, parallax error results in the break appearing more posterior than it actually is and that can result in some errors and actually localizing and marking the retinal break. Indenting the globe to bring the RPE into opposition with the retinal break can help to avoid parallax error. Parallax error is also less of an issue when using chandelier illumination.

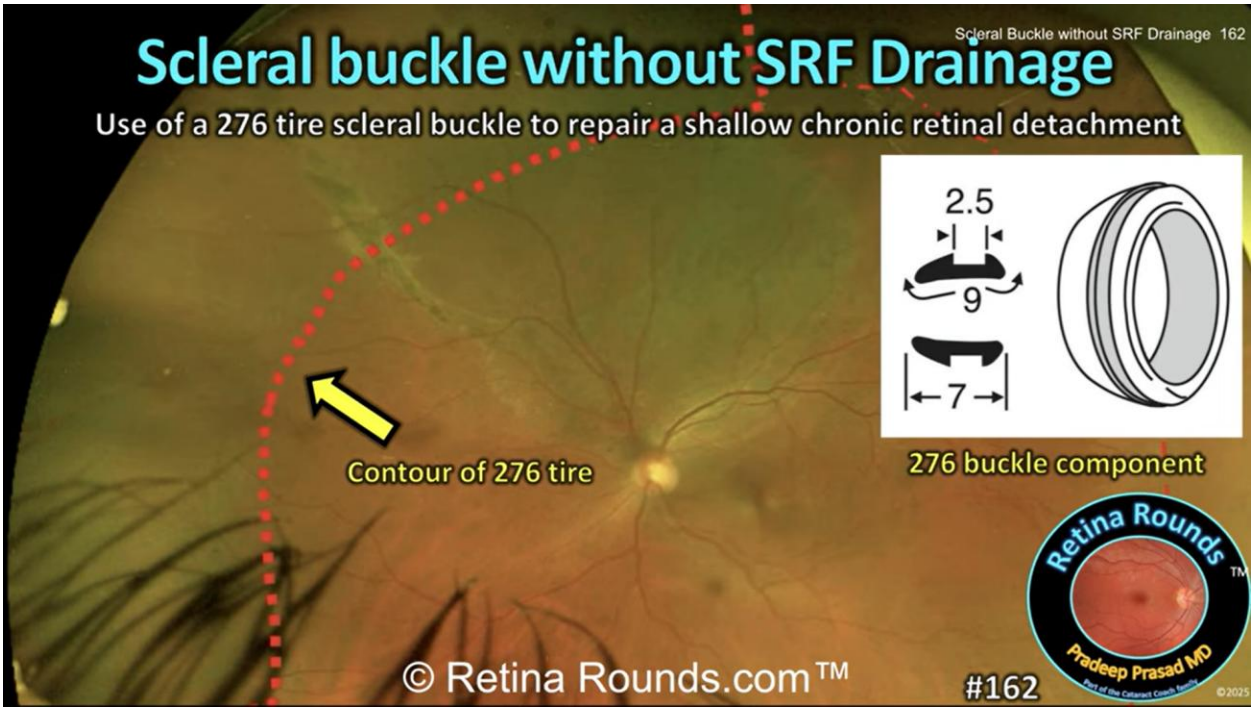
When applying cryotherapy, ideally you want to minimize cryo to the retinal break itself, especially with large retinal breaks, which can cause the RPE to disperse and potentially increase the risk for PVR. A better technique is to apply the cryo around the edge of the retinal break with slightly overlapping cryo spots. The break itself will appear dark, which can help to ensure that the cryo is applied up to and involving the edge of the retinal break.

One very important point when applying cryo is to ensure that you're seeing indentation with the tip of the probe and not the shaft of the probe. If the shaft is visualized, cryo may be applied more posteriorly than is intended and that could threaten the macula. The ideal amount of cryotherapy is a question that often arises. Although whitening of just the RPE may be enough to elicit a chorioretinal adhesion, ideally the cryo should be applied until the retina just begins to whiten, assuming that the RPE and retina are opposed or nearly opposed.

If you have any other tips or tricks for this step, please share them in the comment section. Our next set of videos will cover implantation of different buckle elements as well as subretinal fluid drainage. Thanks so much for watching.

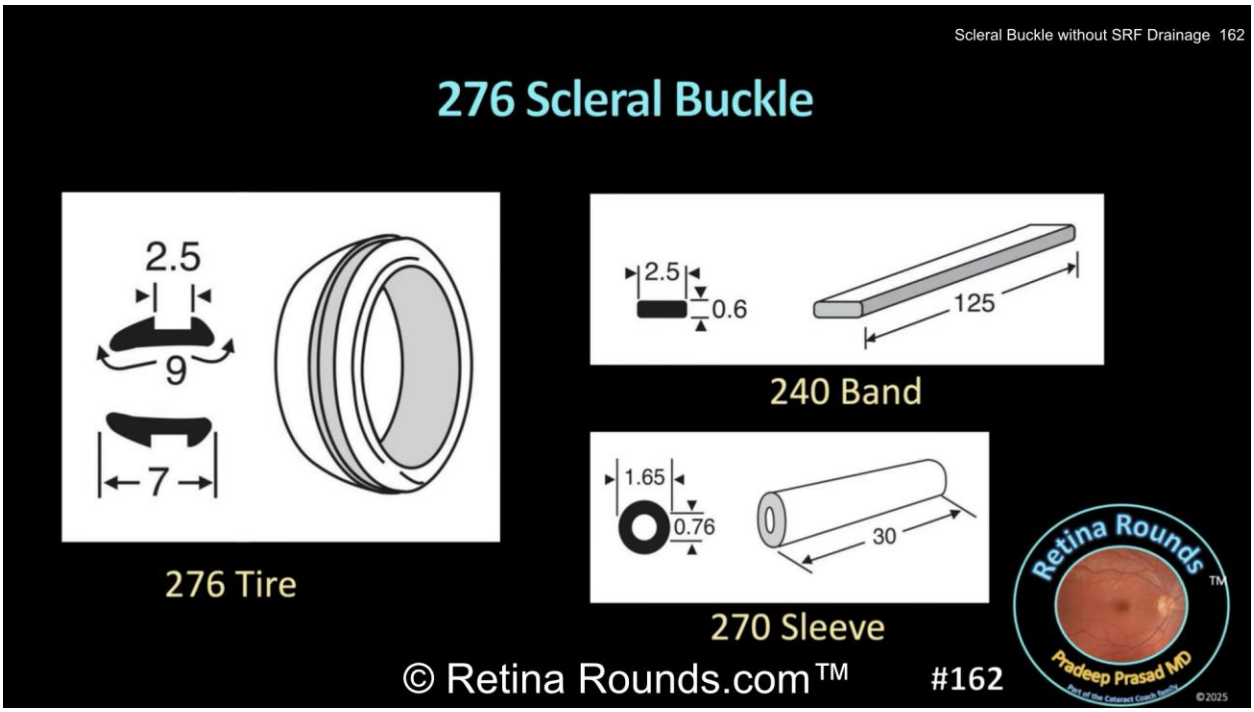
- **Scleral Buckle without Subretinal Fluid Drainage**

Link: https://www.youtube.com/watch?v=COxoP9aBgBA



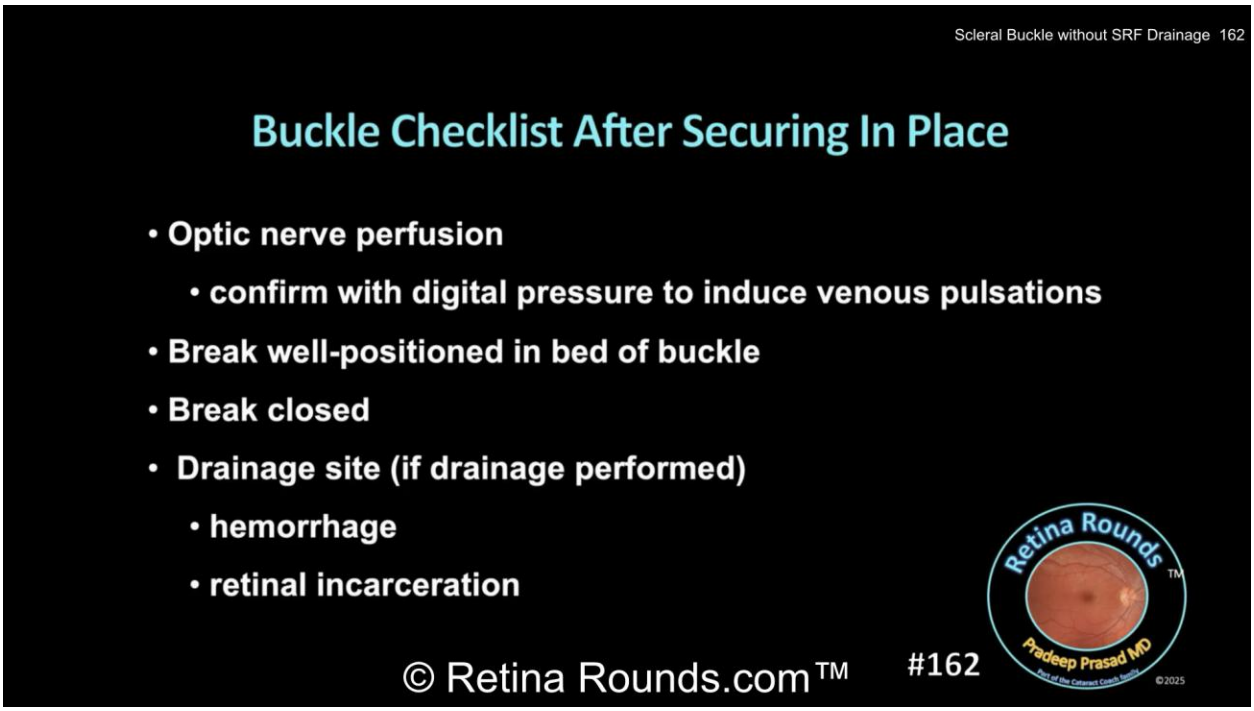
In today's episode we will show you the steps for implantation of a 276 tire along with a 240 band and a 270 sleeve without subretinal fluid drainage. There are a number of scleral buckling elements that surgeons can choose from. During the video we will discuss some of the pros and cons of using a 276 tire and in subsequent videos we will show you implantation of other buckle

elements. The patient in this video is a young phakic patient without a PVD who presents with a superonasal macula-involving retinal detachment that appears to be chronic based on the pigmented demarcation line. The subretinal fluid has now broken through this demarcation line. The causative break is a single small atrophic hole in the superonasal quadrant and the fluid is shallow peripherally.

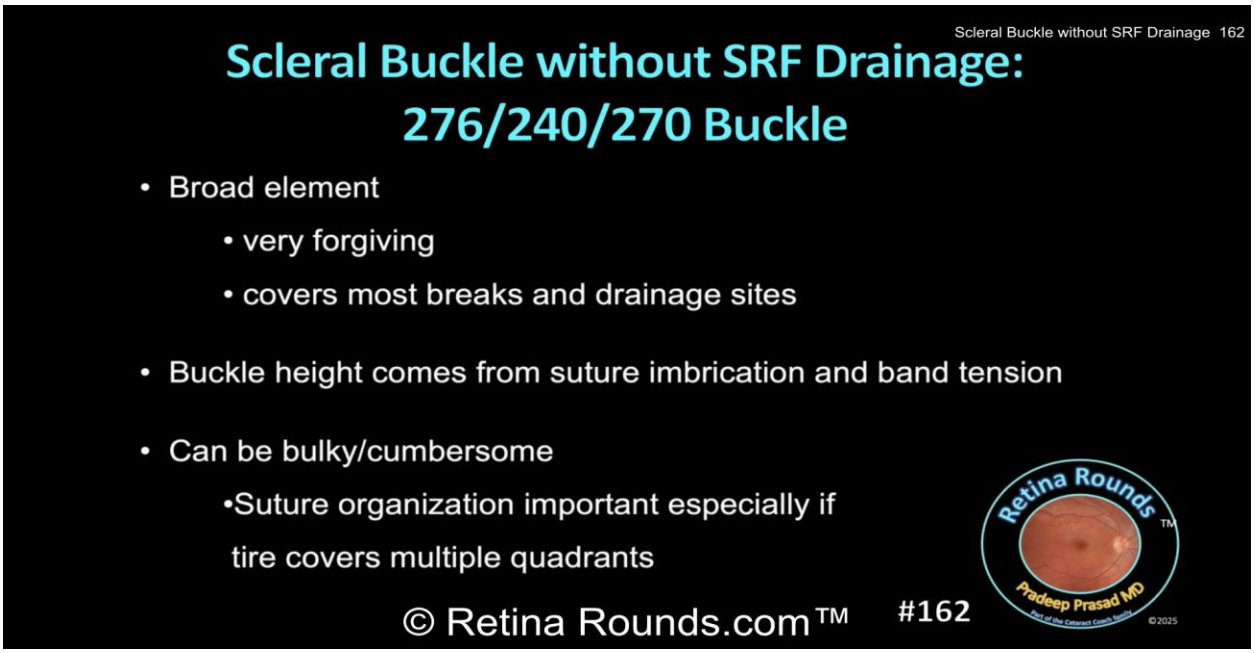


Here are all the buckling elements that you'll need. The 276 tire, you can see, has an asymmetric groove that will accommodate the 240 band. The 276 is 7 mm wide, making it a wider element than most buckles. The advantage is this element is versatile for both anterior and posterior breaks, especially in circumstances where there are both anterior and posterior breaks. You'll notice on the diagram that the width and the height of the buckle measures a total of 9 mm. and 9 mm will be the anteroposterior distance between the mattress style imbricating sutures that will hold the tire in place. The sutures will shorten the sclera anteroposterior to be flush with the surface of the buckle, thus allowing us to achieve the desired buckle height.

The buckle can be cut to the desired length. Most surgeons use the 276 to cover one or two quadrants, although some surgeons use the 276 to cover all four quadrants. Now, one note is that the groove for the band should be oriented posteriorly to give a posterior kick for support. The 240 band is just like any encircling band, except that it's thinner than most with the width of 2.5 mm. The 270 sleeve holds the two ends of the 240 band in place and typically is placed in a nasal quadrant. The height of the buckle will be dictated by both the imbricating sutures used to hold the tire in place as well as the tension on the 240 band. My preference here is to have good imbrication with the sutures and only gently tighten the buckle which allows for an adequate buckle height without inducing a significant amount of myopia.



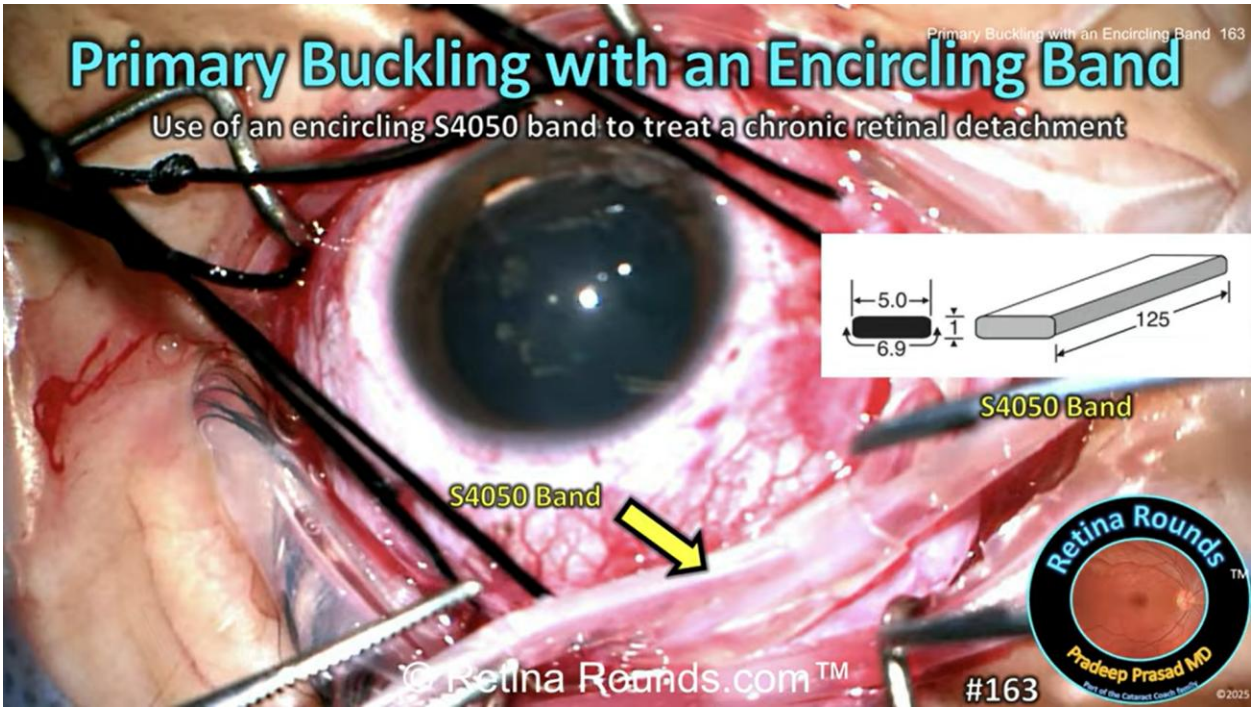
Here's my checklist. First, I want to look at the optic nerve to make sure that it's profused. If I'm unsure, I can confirm normal IOP by applying pressure on the eye with my finger to elevate the IOP above a normal level. That should induce spontaneous venous pulsations. Once I've seen that, I can relax the digital pressure and the venous flow should be normalized, which then confirms that the IOP is in an acceptable level. If the IOP is still high, an additional AC tap can be performed. Next, we want to make sure that the break is well positioned on the buckle and that the break is closed. If drainage is performed, we also want to ensure that there's not any significant hemorrhage or retinal incarceration.



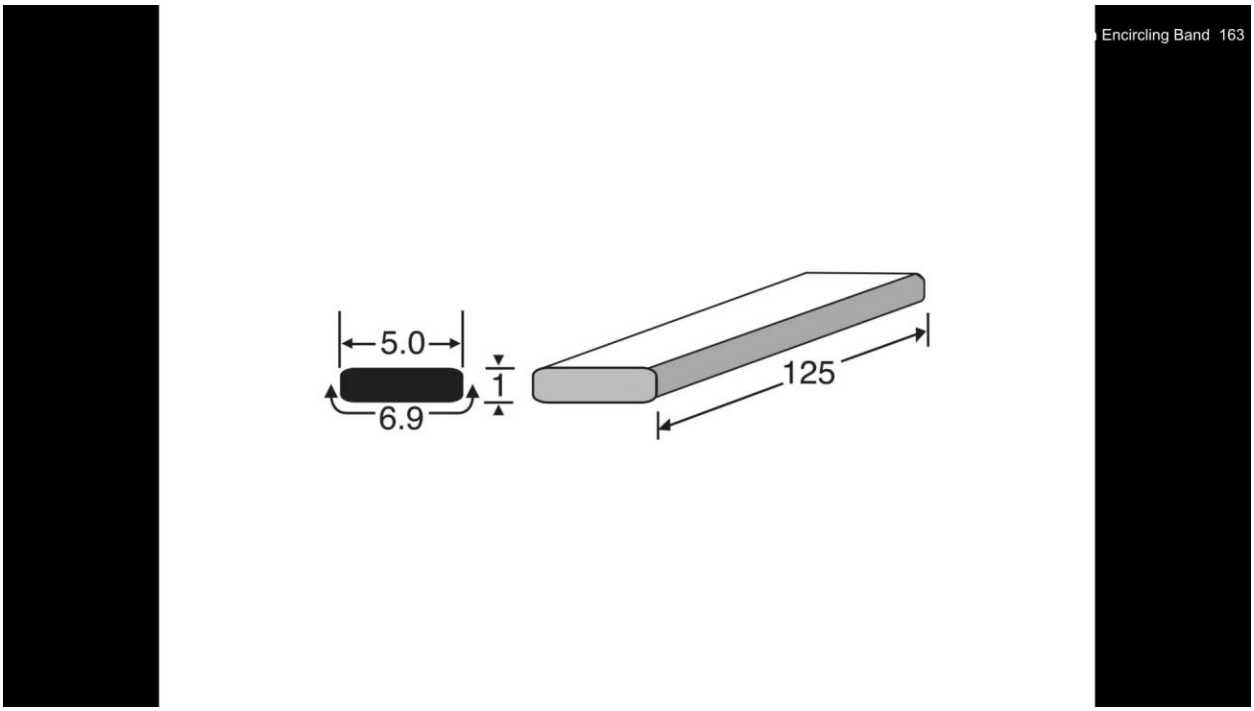
So here are some summary points. The 276 tire is a broad element and I personally like it since it's very forgiving to cover most breaks and subretinal fluid drainage sites. The height of the buckle will be dictated by the degree of suture imbrication and the tension on the encircling 240 band. But my preference is to use the sutures to achieve the desired buckle height with tension on the band serving just to support the vitreous base in the other quadrants and to hold everything in place. Now one downside of the 276 is that it can be bulky and cumbersome compared to a single thinner encircling band. But it does become easier to use with increased practice. Since multiple pre-place sutures may be used, it's really important to ensure that there's good suture organization to avoid the sutures getting crossed or tangled. Thanks so much for watching.

- **Primary Buckling with an Encircling Band**

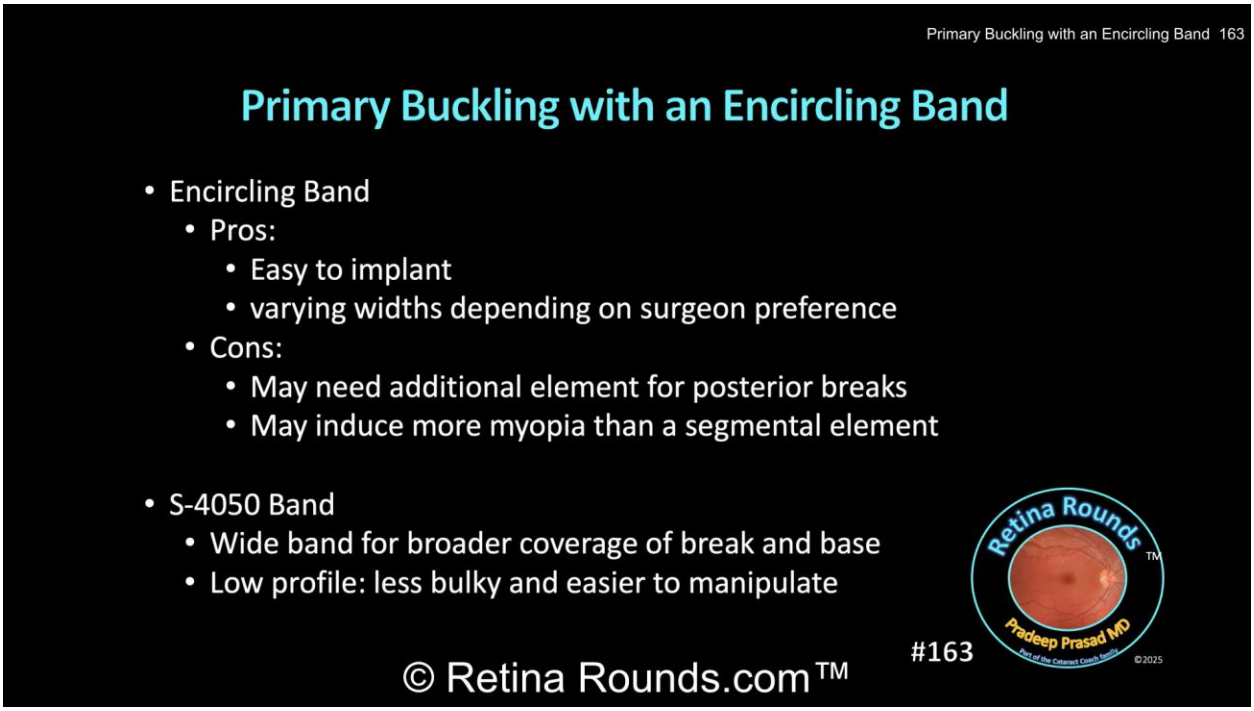
Link: https://www.youtube.com/watch?v=z_25tG4Q8wA



In our last video we showed you a primary buckle with a 276 segmental tire. In today's episode we will review primary buckling with an encircling band. This patient is a young phakic myope without a PVD who has a slowly-progressive retinal detachment secondary to an inferotemporal atrophic hole. The patient has multiple areas of peripheral lattice degeneration and the decision was made to use an encircling band, not only to close the break, but also to support the vitreous base in the other areas of peripheral pathology. Let's check out the video and at the end we will discuss some pros and cons of using an encircling band as a primary buckle.



The implant used in this case is an S4050 band. You can see that it's wider than most encircling bands at 5 mm in width. And for comparison, the 41 band has a width of 3.5 mm. Although it's wide, it does not have a very high profile, measuring at 1 mm in height. And again, for comparison, a 42 band, which has a 4 mm width, has a height of 1.25 mm. The benefit of this element is that it provides broad support, but at the same time isn't too bulky, making it easy to implant.

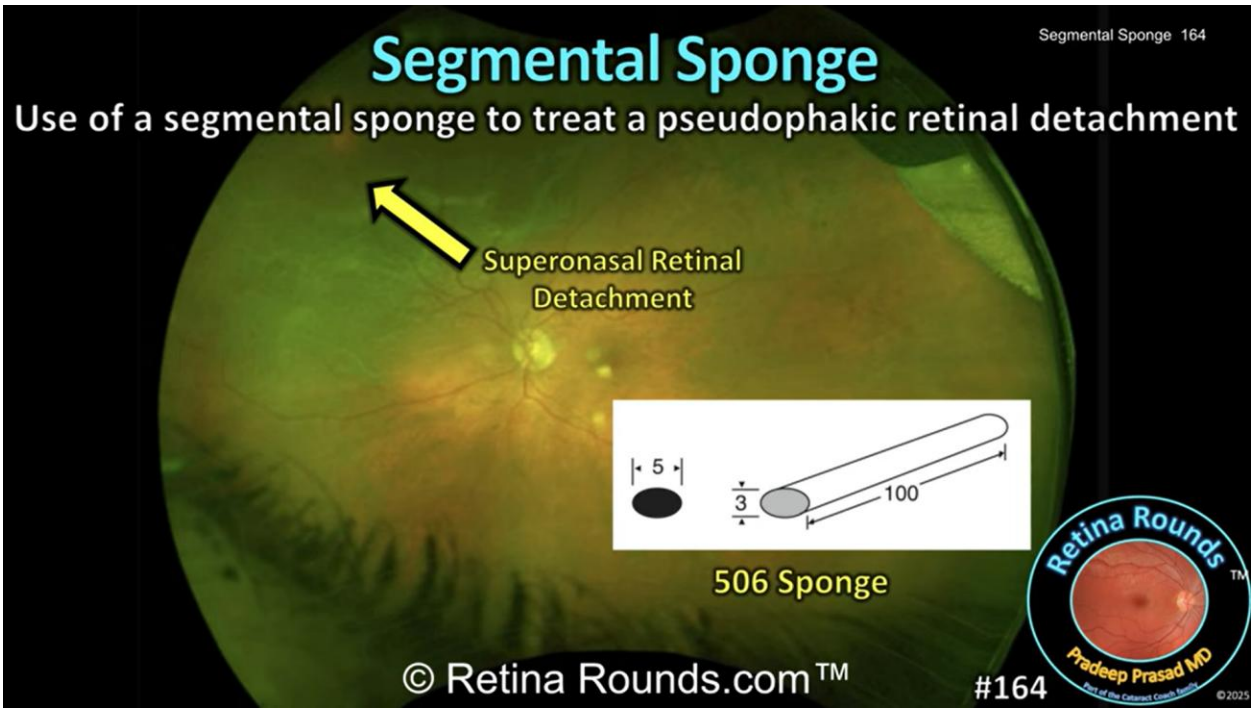


Here's some take-home points. When using an encircling band as a primary buckling element,

the benefit is that it's relatively easy to implant. As we discussed earlier, there are a variety of bands with varying widths and the surgeon can therefore choose the appropriate band to address the patient's pathology. Now, a downside of encircling bands is that it may be a little bit harder to address posterior breaks or if there are multiple breaks at different distances from the ora. In this scenario, an additional element may be needed in order to address posterior breaks. The other downside is that the buckle height often is going to be determined by the tightness or tension on the band. The more tension, the higher the buckle, but also the greater the amount of induced myopia. Segmental elements on the other hand can allow you to achieve a localized buckle height with the suture imbrication without a significant amount of circumferential band tension. So, you can sometimes decrease the amount of induced myopia using a segmental element versus an encircling element. The S450 band as we've discussed is a wider encircling band with a low profile which gives you sort of the best of both worlds. A wider element with broader coverage while also being less bulky and easier to manipulate. Thanks for watching.

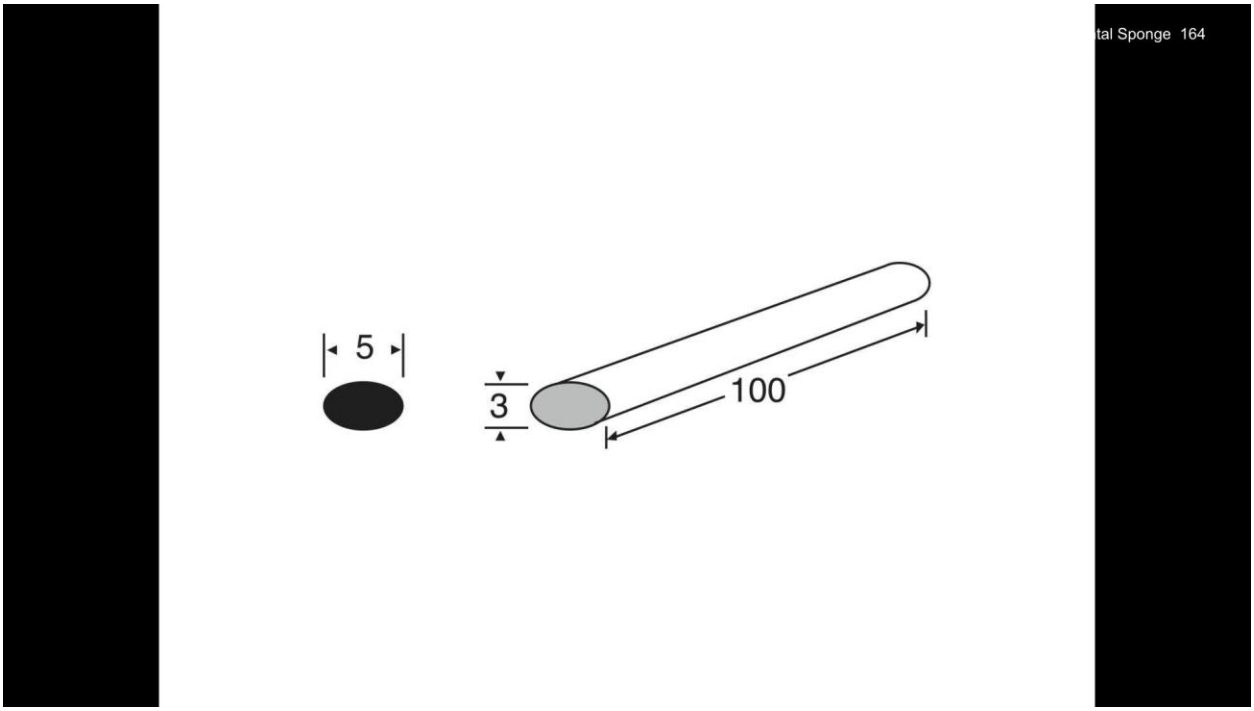
- **Segmental Sponge**

Link: https://www.youtube.com/watch?v=Huv9lPVSS5I



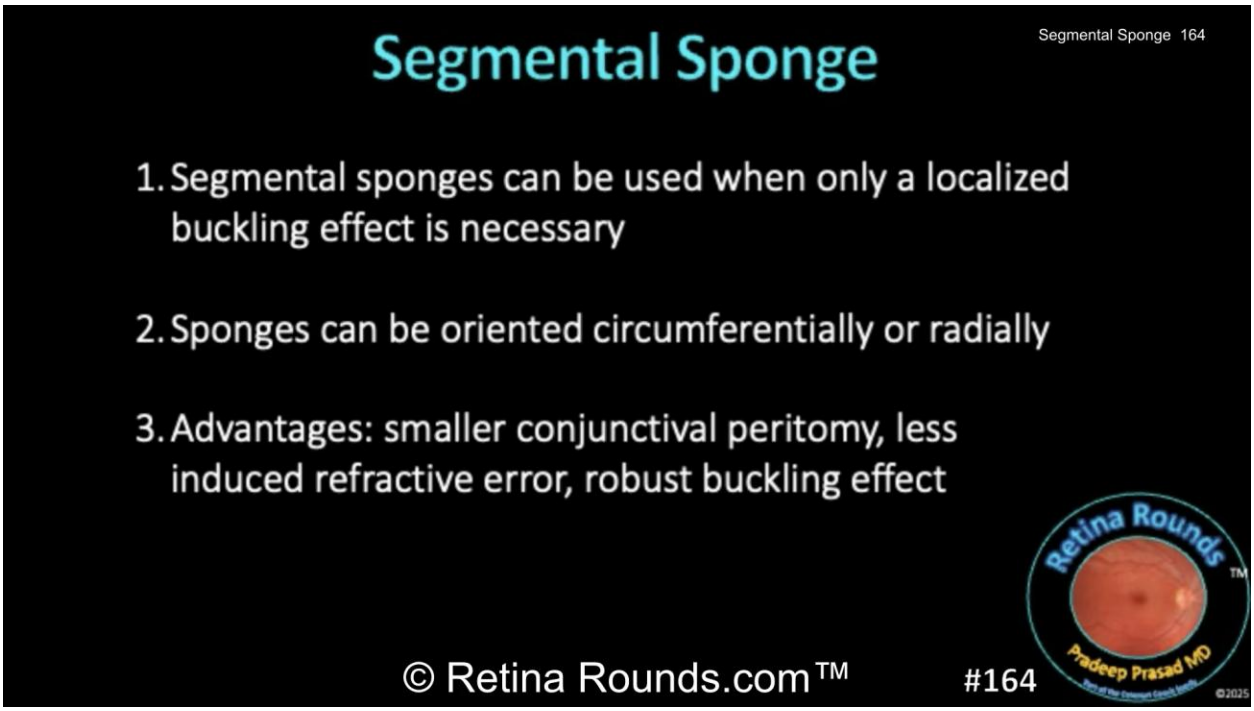
In today’s episode we’ll show you how to use a segmental sponge when scleral buckling for a localized retinal detachment. Our patient has a superonasal retinal detachment associated with a PVD and a single superonasal retinal break. The patient doesn’t have any other peripheral retinal pathology on scleral depressed examination. In this type of case most people would probably opt for a primary vitrectomy with gas implantation, but this patient lives at high altitude, is from out of town, and needs to return home. We’d like to avoid using silicone oil which would require another

operation down the road and since the patient is pseudophakic with pre-op vision of 20/30 without correction we'd like to avoid inducing refractive error. For these reasons we are going to use a segmental sponge. At the end of the case we discuss some tips when implanting segmental sponges and reasons to consider using a segmental buckle in select cases.



So, for this particular case, we're going to recommend a scleral buckle. A circumferential scleral buckle that encircles the eye 360° is certainly an option. However, that will likely induce some refractive error. Now this patient is pseudophakic and the preop vision is 20/30 without correction. So, we'd like to avoid inducing a refractive error in this case. We're going to use a segmental element instead of an encircling element. The segmental element that we've opted to use for this case is a 506 sponge. Just as there are many different types of scleral buckling elements that are made out of solid silicone, there are also many different sponge elements that you can choose from. The 506 sponge is easy to work with and it's certainly wide enough to be able to cover this break. It has a 5mm width.

One thing to keep in mind here is the material. This sponge is made out of silicone and is highly stable. It is unlike older style sponge elements like the mirror gel sponge which has been found to degrade over time, can predispose patients to infections, and can actually be very difficult to remove when it's in its degraded form. Another thing to note about scleral sponges, which is a little bit different than solid silicone scleral buckling elements, is that the buckling effect is very easy to achieve by tightening the sutures used to hold the sponge in place. We're going to place our sutures 7 mm apart. So, we're going to add a millimeter on each side so that when we tighten the sutures, the sclera is going to ride up right at the level of roughly the equator of the scleral buckle element, which is shown here. If we tighten too much, it's very easy to get a very high scleral buckling effect. And of course, if we don't tighten enough, we won't get enough of a scleral buckling effect.



Here are some take-home points. Segmental sponges can be very useful when trying to address a localized retinal detachment. There may be a variety of reasons why you want to do just a localized segmental element rather than a full encircling scleral buckle. One of those reasons might be to minimize the amount of induced refractive error. But other reasons might include other hardware that's in the eye or scarring from other surgeries that you want to try to avoid. For example, patients who have had tube shunts, patients who have a trabeculectomy that you don't want to disrupt or maybe the patients had prior scarring from strabismus surgery that happens to be in an area that you don't need to access for placement of the scleral buckle. These would all be reasons why you could opt for just a segmental element, a segmental sponge rather than an encircling element.

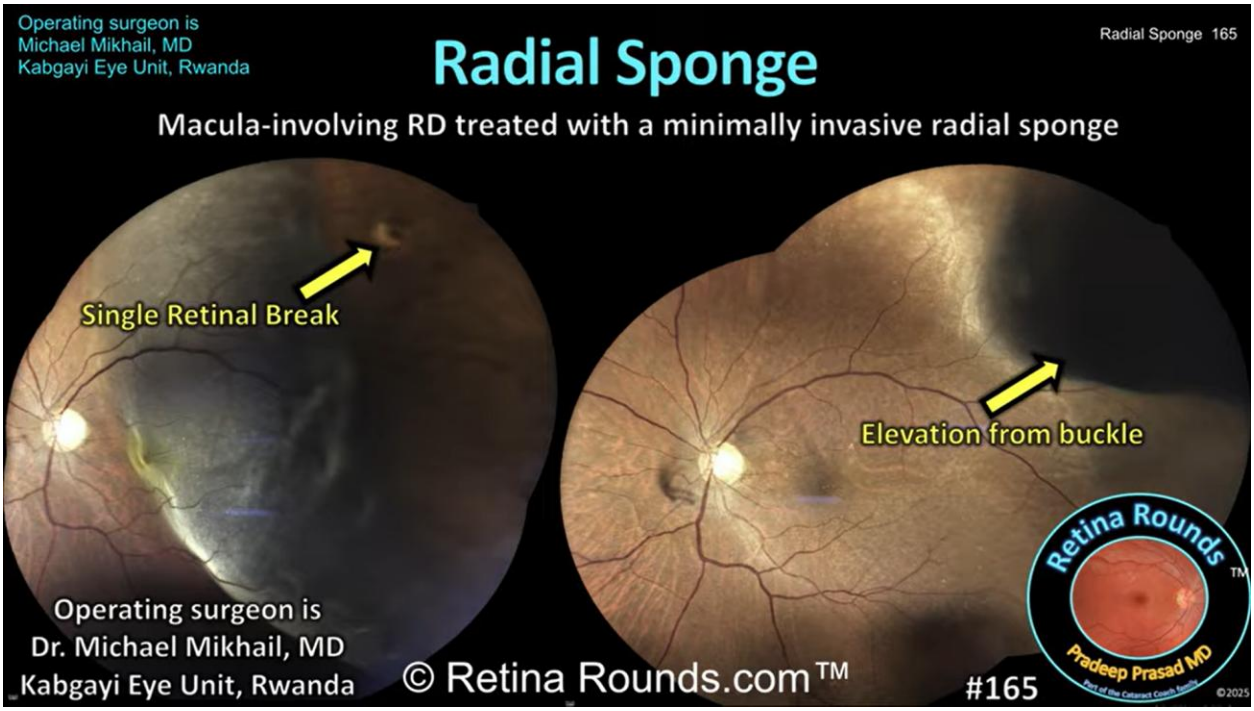
In this case we oriented the sponge circumferentially so that it follows a path parallel to the limbus underneath in this case to just the two rectus muscles but the sponge can also be oriented radially so that it's perpendicular to the limbus and going in an anteroposterior fashion and we'll show you a video of a radially oriented sponge in an upcoming video.

Some of the advantages of using a segmental sponge is that it can be a bit less invasive since you can create a smaller conjunctival peritomy just in the area that needs to be addressed, in this case just the superonasal quadrant. Another benefit of just having a segmental element rather than a full encircling element is that you can have less of a chance of induced refractive error, certainly less of a chance of induced myopia. There can still be some induced astigmatism. Overall, the induced refractive error is less with segmental elements. That was demonstrated in this case since the patients uncorrected visual acuity was largely unchanged. Finally, segmental sponges can be associated with a very robust buckling effect. it's much easier to get a high buckle with the segmental sponge compared to a solid silicone element. So just keep that in mind when you're using the buckle in place. You don't want to overtighten the sutures as we did in this case.

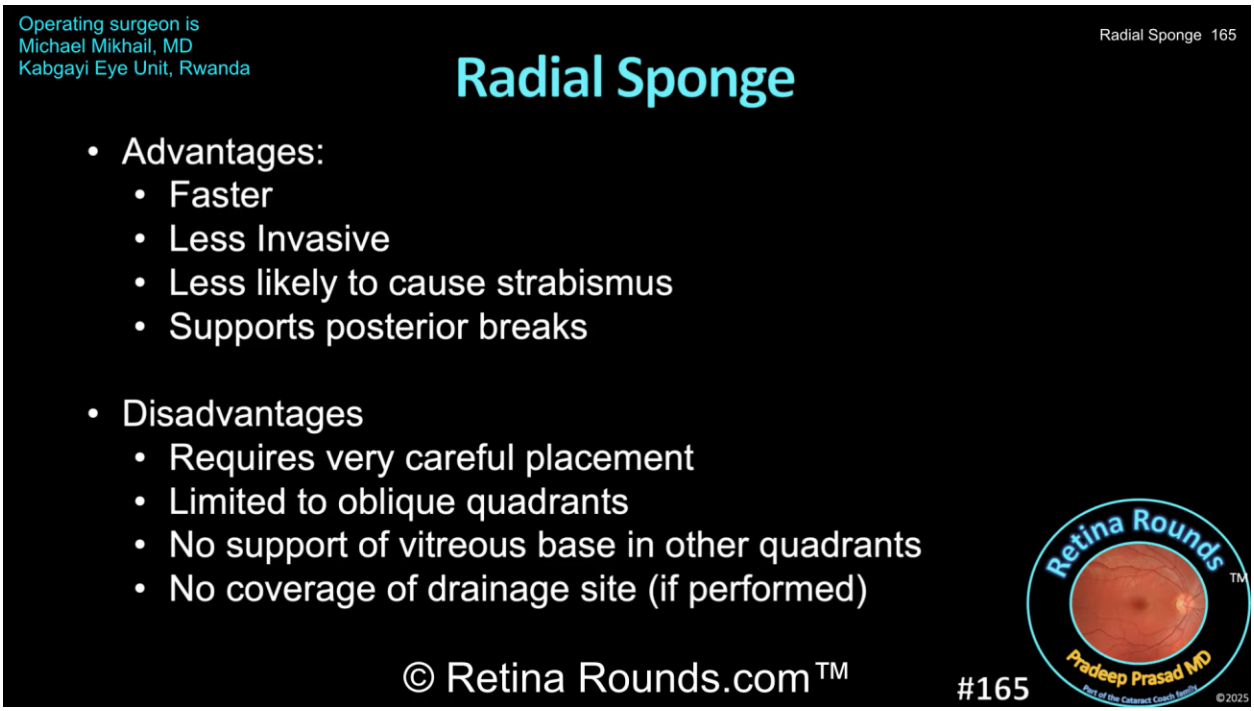
You can place temporary ties into a final visual confirmation that you're happy with the buckle height and position. The temporary ties give you a little bit of flexibility to adjust the sutures if any modifications are needed. Thanks so much for watching.

- **Radial Sponge**

Link: https://www.youtube.com/watch?v=OpFFauX6DY4



In today's video we will show you how to treat a retinal detachment with a minimally-invasive radial sponge. The case is presented by guest surgeon Dr. Michael Mikhail from the Kabgayi Eye Unit in Rwanda. The patient is a phakic individual with a PVD-associated retinal tear in the superotemporal quadrant of the left eye. You can see that subretinal fluid has extended into the macula and the fovea is detached. The patient does not have any other peripheral retinal breaks or peripheral pathology such as lattice degeneration. While multiple approaches including pneumatic retinopexy and vitrectomy can be employed to treat this detachment, a buckle is a great choice. Since this break is in the superotemporal quadrant it makes for easy access to place either a segmental circumferential buckle or a radial element. In this case Dr. Mikhail has opted to place a radial element and at the end of the case we will discuss some of the pros and cons of this approach.

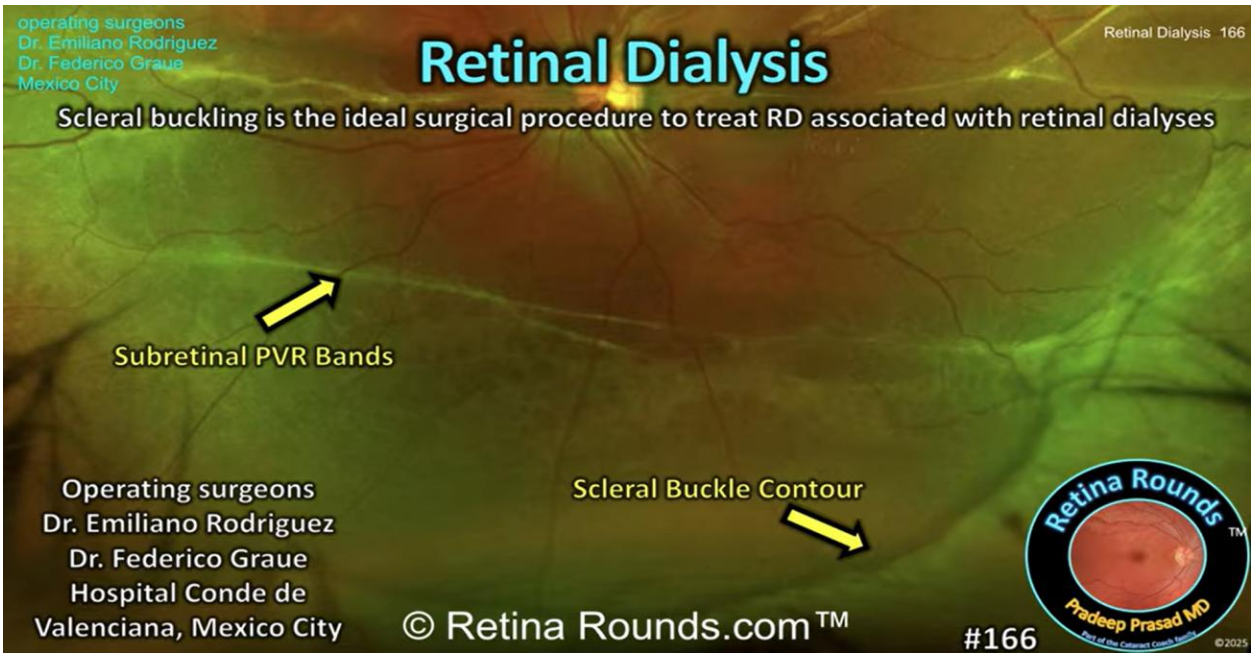


here are some take-home points. There are a number of advantages to using a radially oriented sponge. First, the procedure can be safer. It's less invasive, as is demonstrated in this case. It's less likely to cause strabismus since the buckle element doesn't go underneath the muscles. It can nicely support more posteriorly located breaks or long and narrow retinal breaks. The disadvantage, however, is that the placement of the sponge needs to be very accurate. And this point is very important. You have to be sure that the break is properly marked and that the buckle is oriented to properly close and support the break. If the break is on the edge of the buckle, the surgery may not be successful. The surgeon needs to double and triple check to make sure that the break is properly marked. They can also consider placing a temporary tie with the sutures in case the buckle position needs to be modified. Also, radially oriented sponges cannot be easily placed under the rectus muscle. So, the break needs to be in an oblique quadrant. Of course, since this is not an encircling element, you won't get support of the vitreous base in other quadrants and you can't cover multiple bricks that could be located in multiple clock hours.

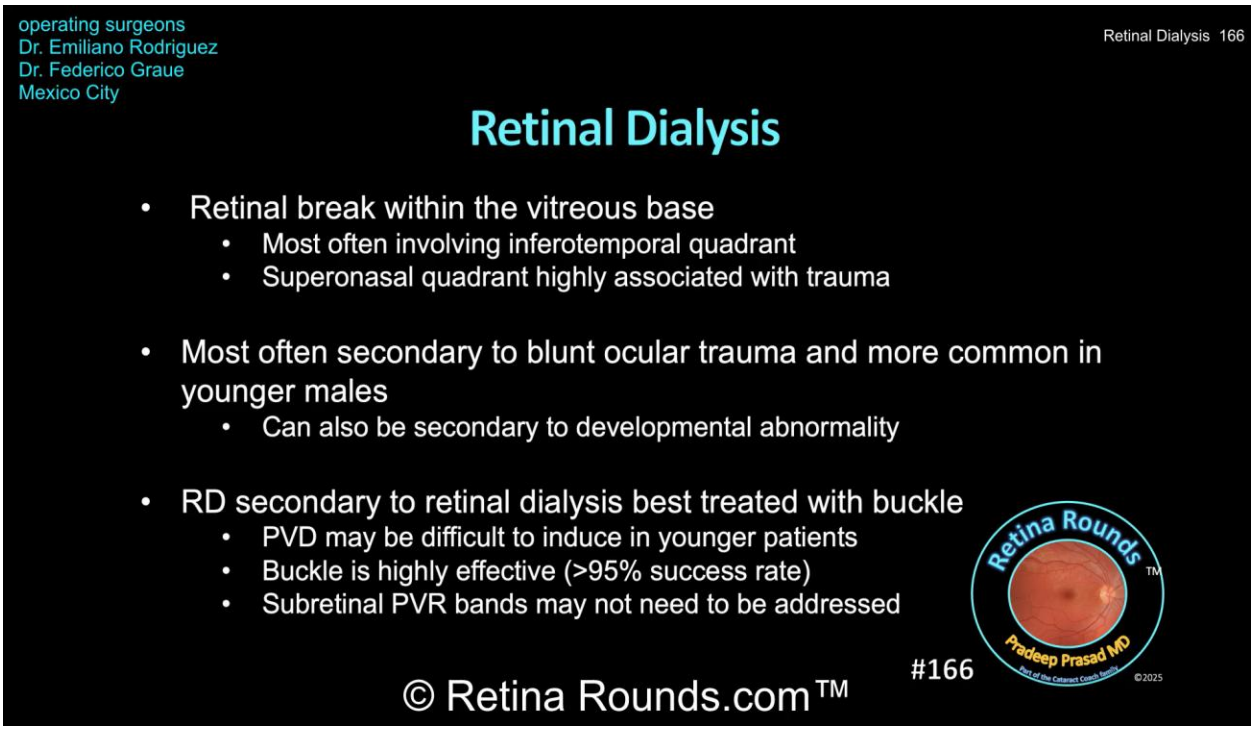
Finally, if drainage is performed, the radially oriented element will not provide any support to the drainage site in the event of a retinal incarceration. With that said, radially oriented sponges can be a quite elegant surgical approach and can yield outstanding results when expertly placed. We want to thank him again very much for sharing this technique with us. Thanks so much for watching.

- **Retinal Dialysis**

Link: https://www.youtube.com/watch?v=kD8q9winNLE



In today's episode we welcome guest surgeons Dr. Emiliano Rodriguez, a second-year vitreoretinal fellow at the Hospital Conde de Valenciana in Mexico City, and his attending Dr. Federico Graue. They will show us the surgical management of a retinal detachment secondary to a retinal dialysis with a scleral buckle. The implant they have chosen is a segmental, circumferentially oriented 505 sponge. At the end of the case we will discuss why scleral buckling is the ideal procedure to manage retinal detachments secondary to retinal dialyses. Thank you, Drs. Rodriguez, and Graue for sharing this case!

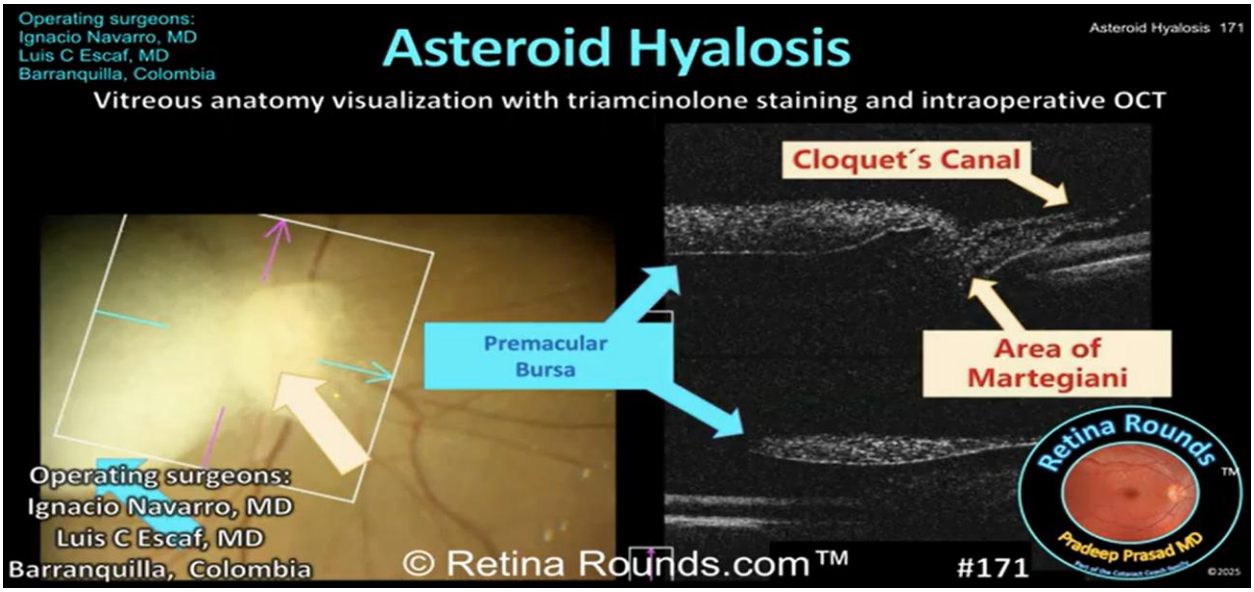


Now, here are some take-home points. Retinal dialyses are defined as retinal breaks that are within the vitreous base and often, they're located very close to the ora. For a review of vitreous space anatomy, please check out episode number 64. Now, dialysis most often involves the inferotemporal quadrant, but the second most common location is the superonasal quadrant, which is highly associated with a history of trauma. Dialyses often affect young males. And while blunt trauma is the most common cause, developmental abnormalities of the of the retina and the vitreous space can also cause retinal dialysis. A retinal dialysis alone without a retinal detachment can be treated just like a regular break with either laser photocoagulation or cryopexy barricade. When a retinal dialysis leads to a retinal detachment, the detachment can be slowly progressive. Since dialysis are often seen in younger patients, the liquefied vitreous entering the subretinal space is often more viscous which may contribute to their slower progression.

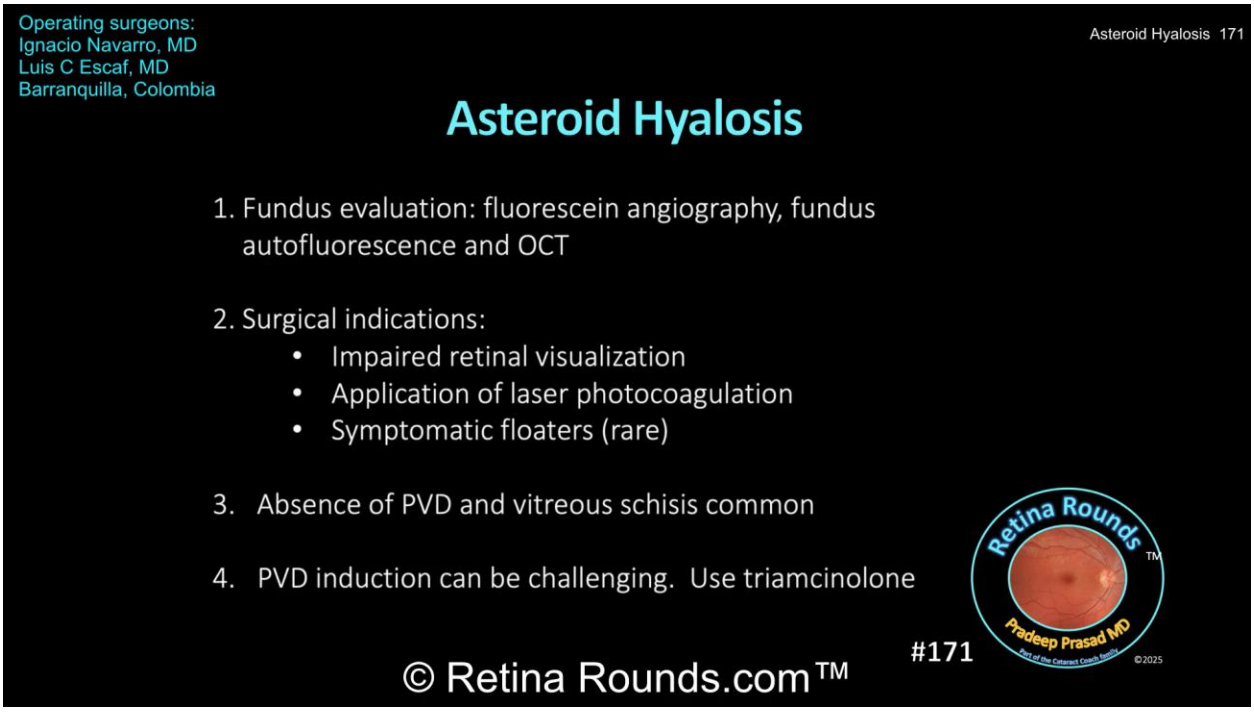
Scleral buckling is the ideal choice to manage retinal detachment secondary to retinal dialysis for a number of reasons. First, it has a very high single surgery success rate, often greater than 95%. Second, buckling is ideal for younger patients without a PVD and a clear lens. PVD induction with vitrectomy can be more challenging in younger patients and runs the risk of iatrogenic retinal breaks and vitrectomy with gas or oil implantation will result in accelerated cataract progression and the need for additional surgical intervention. Third, given that dialyses are often associated with trauma in younger patients, placement of a buckle can help to support the vitreous base and decrease the effects of PVR if present. Even if subretinal PVR bands are present, a buckle alone can successfully reattach the retina, which is nicely demonstrated in this case. The choice of the buckling element is ultimately up to the surgeon. I generally place an encircling band to support the vitreous space 360. But a segmental element as shown in this case is reasonable as well as long as there is no pathology in other quadrants. Thanks so much for watching.

- **Asteroid Hyalosis**

Link: https://www.youtube.com/watch?v=wA0d1_cioPk



Vitrectomy for asteroid hyalosis is rarely necessary but may be indicated for impaired visualization of the retina (even with alternative imaging modalities), for application of laser photocoagulation (such as PRP), or more rarely when the asteroid bodies are visually significant. Vitrectomy in cases of asteroid hyalosis can be challenging to the frequent absence of a PVD or due to the presence of vitreous schisis. Our guest surgeon is Dr. Ignacio Navarro, a first-year vitreoretinal fellow at Clinica Oftalmologica del Caribe in Barranquilla, Colombia. He and his attending, Dr. Luis C. Escaf, perform a vitrectomy on a patient with visually significant asteroid bodies. They use triamcinolone staining and intra-operative OCT to nicely highlight vitreous anatomic findings. Thank you Drs. Navarro and Escaf for sharing this case!



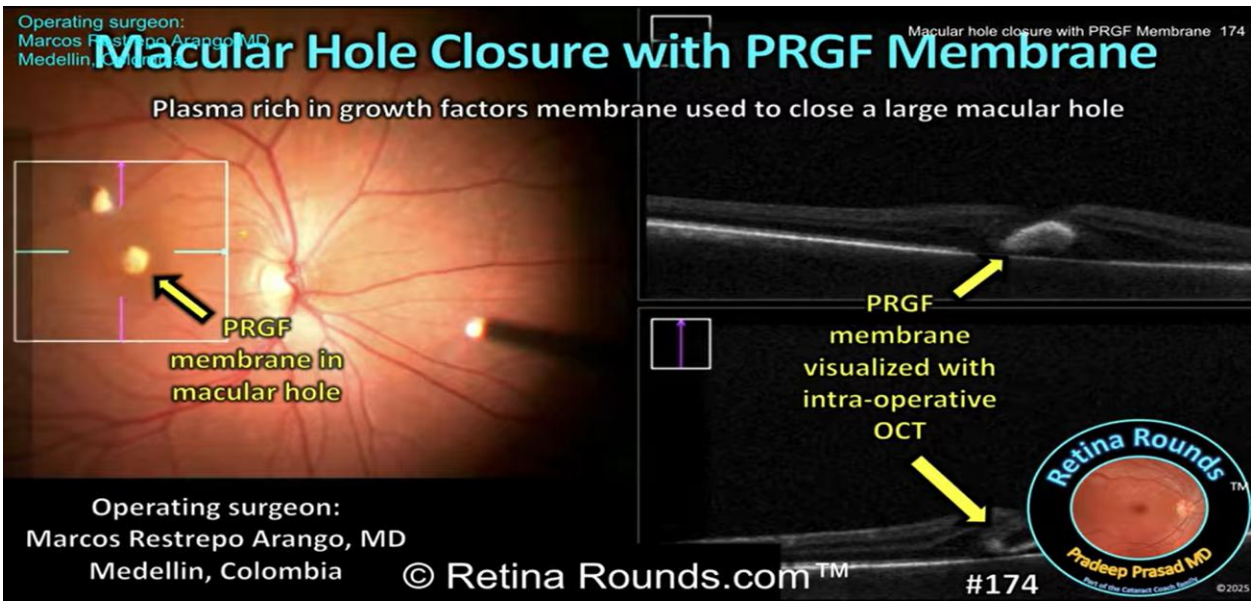
So here are some take-home points. Asteroid hyalosis is rarely visually significant and fundus evaluation can be achieved using fluorescence angiography, autofluorescence and OCT.

Indications for vitrectomy for asteroid hyalosis include impaired retinal visualization, the need to apply laser photocoagulation or if the asteroid bodies are visually significant as was the case in the surgery. A PVD in eyes with asteroid hyalosis is rarely present and PVD induction can be challenging. Additionally, the surgeon should be aware of the possibility of vitreoschisis.

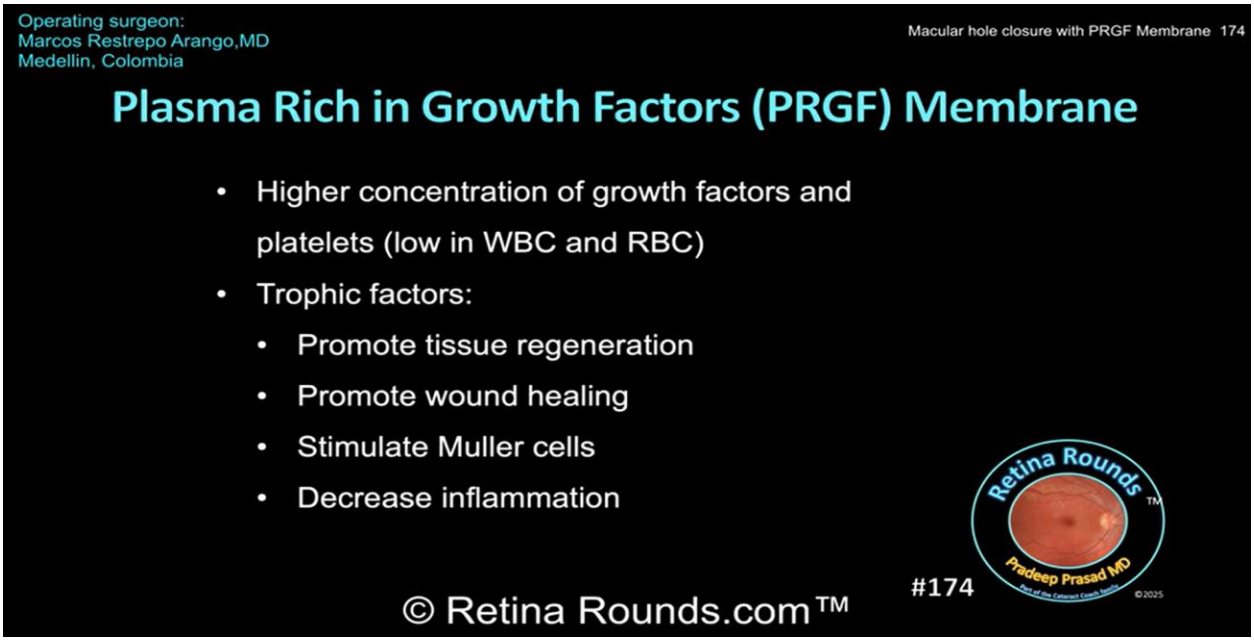
Staining with triamcinolone as was demonstrated in this case is critical to ensure that the PVD has been successfully induced and sometimes instruments other than the vitreous cutters such as forceps may be necessary to elevate the posterior hyaloid. Triamcinolone assisted PVD induction was nicely demonstrated in this case as well as the intraoperative visualization of posterior vitreous anatomic landmarks using intraoperative OCT.

- **Macular hole closure with PRGF membrane**

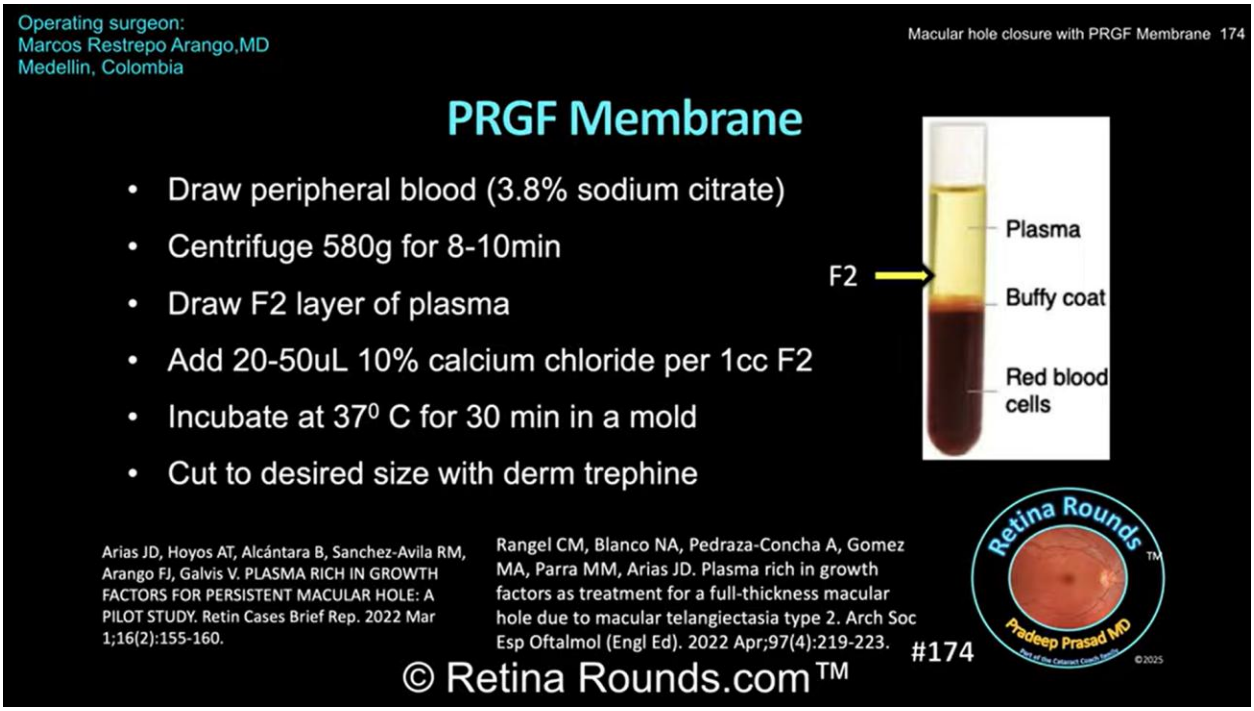
Link: https://www.youtube.com/watch?v=xXGXsU8ENd4



Traditionally macular hole closure has a high success rate with vitrectomy, ILM peeling and gas implantation. ILM peeling, however, does have a risk of iatrogenic retinal trauma and Muller cell disruption. In today's episode we will show you an alternative technique using a membrane made from autologous plasma rich in growth factors. To demonstrate this technique, we welcome guest surgeon Dr. Marcos Restrepo Arango, a vitreoretinal surgeon at Universidad Pontifica Bolivariana in Medellin, Colombia. At the end of the case we will review how to make a PRGF membrane and the potential wound healing benefits of this technique. Thank you Dr. Restrepo Arango for sharing this case!



Here are some discussion points. The plasma fraction used to make a PRGF membrane has a high concentration of growth factors and platelets with a much lower concentration of white blood cells and red blood cells compared to whole blood. It's hypothesized that the trophic factors from PRGF membranes can promote tissue regeneration, wound healing, stimulate muller cells and decrease inflammation. The membrane itself may serve as a scaffold to encourage macular hole closure.



So how do you make a PRGF membrane? Well, the protocol used by Dr. Restrepo Arango is based on the one described by Dr. Arias in 2022. On the day of surgery, the patient's peripheral blood is drawn in a 3.8% sodium citrate tube to prevent blood clotting. The peripheral blood is then spun in a centrifuge at 580 g for 8 to 10 minutes. This will result in three discrete layers as shown in the picture to the right. The bottom red layer is rich in red blood cells. The white layer above this which is called the buffy coat is rich in white blood cells and the straw-colored layer above that is the plasma. The layer of plasma just above the buffy coat is the F2 fraction of plasma which is rich in growth factors and this is the layer that should be drawn to create the PRGF membrane and care should be taken to avoid disruption or drawing of white blood cells from the buffy coat when extracting the F2 fraction. A second spin of the plasma layer can be performed to further separate any residual white blood cells. The F2 layer is then activated with 10% calcium chloride, which is approximately 20 to 50 microL per 1 cc of the F2 layer. The activated F2 fraction is then placed in a mold and allowed to incubate at 37° C for 30 minutes. This will form a membrane which can then be cut and used during the surgery. Dr. Restrepo Arango uses a dermatologic trephine to precisely cut the membrane to the desired size.

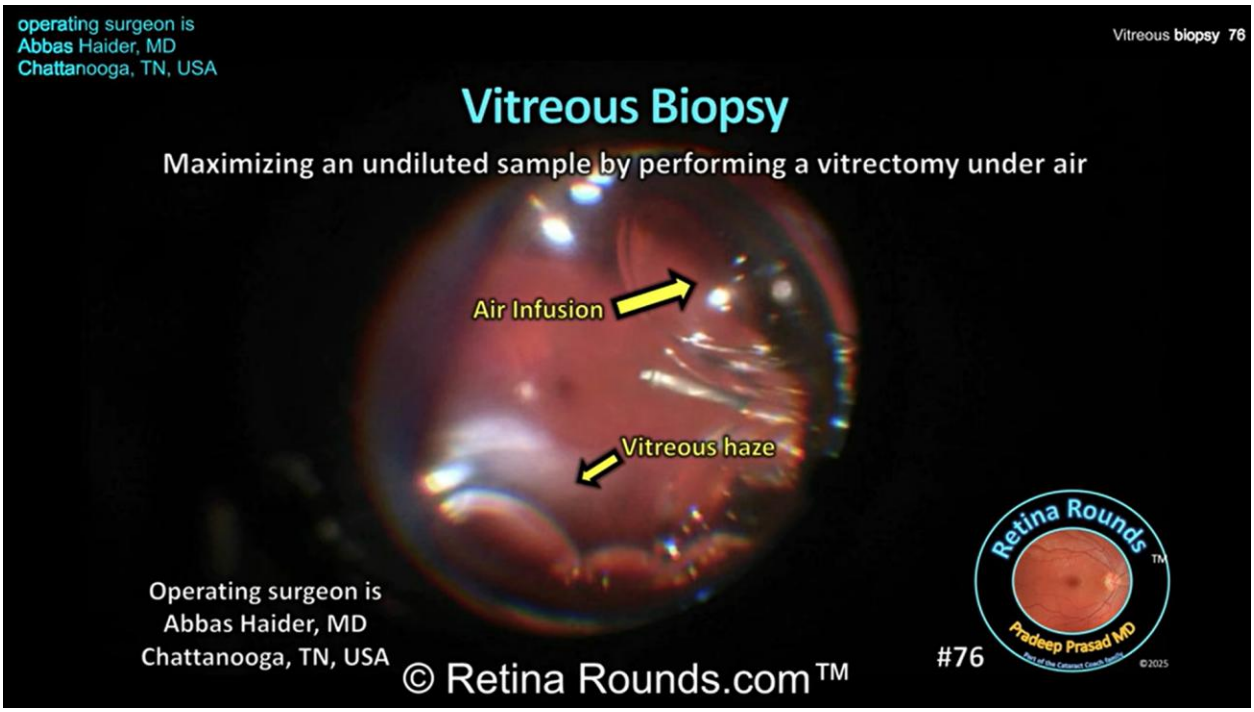
While Dr. Restrepo Arango did not peel ILM during the surgery, some surgeons peel ILM when placing a PRGF membrane. Limited case reports have demonstrated the utility of PRGF membranes to close persistent macular holes and macular holes associated with macular

telangiectasia. Although Dr. Restrepo Arango used this technique for primary macular hole closure, surgeons may want to consider this technique in cases of difficult to close macular holes as an alternative to either amniotic membrane or autologous retinal transplants.

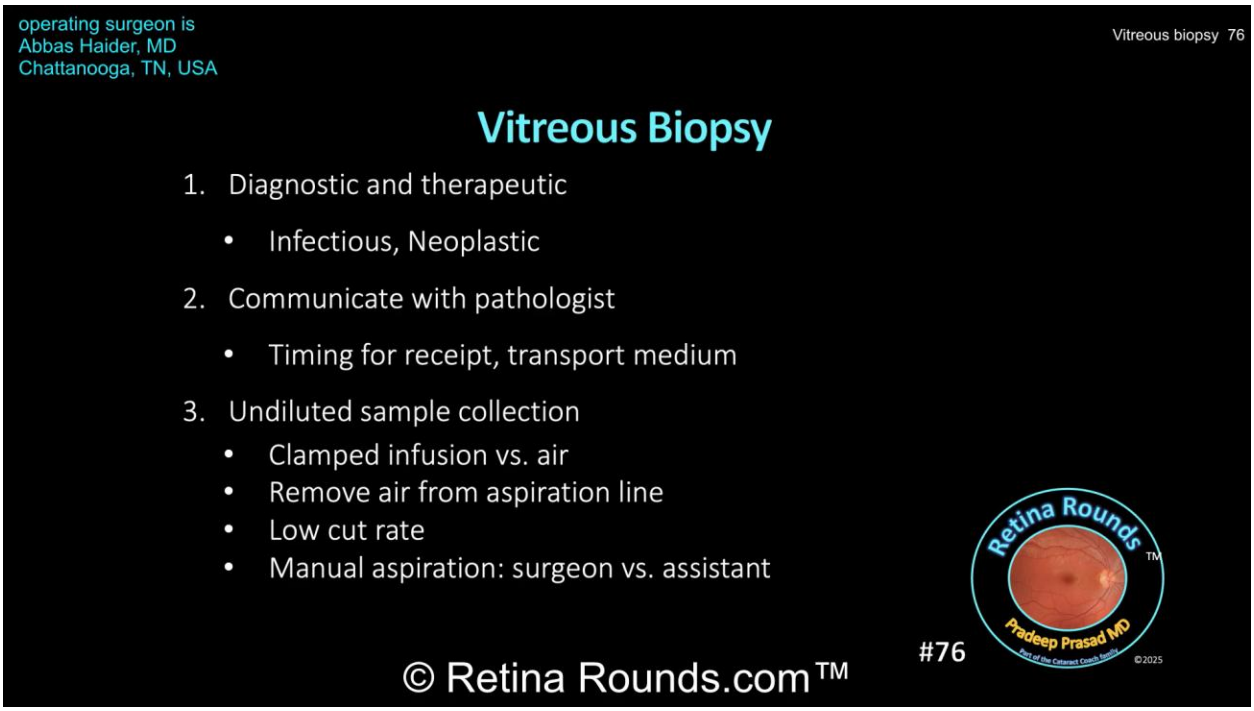
We want to thank Dr. Resto Orango for sharing this very innovative technique and for giving us an opportunity to learn more about alternative techniques for macular hole closure. Thanks so much for watching.

- **Vitreous Biopsy**

Link: https://www.youtube.com/watch?v=pfRiuu9rRKI



There are a number of indications for performing a vitreous biopsy, which is typically performed for diagnostic purposes but can also be a therapeutic measure to remove vitreous opacities to clear the visual axis. Typical indications include confirmation of suspected vitreoretinal lymphoma as well as identification of the etiology of infectious endophthalmitis, particularly in cases where a needle vitreous tap has not yielded a causative organism or to identify atypical infectious organisms. When performing a vitreous biopsy, obtaining an undiluted specimen can improve the diagnostic yield. In today's episode, returning guest surgeon Dr. Abbas Haider from Chattanooga Tennessee demonstrates a technique of obtaining an undiluted specimen by infusing air during vitrectomy. We want to thank Dr. Haider for his contribution!



Here are some summary points. Vitreous biopsy by performing a PPV may be performed for both diagnostic and therapeutic indications to remove vitreous capacities that may be obscuring the visual axis. It's important prior to vitrectomy to communicate with the receiving pathologist to discuss the suspected ideology which may guide diagnostic testing and to discuss logistics of specimen submission including timing to make sure someone is able to receive and process a specimen in a timely fashion and to decide on any transport media that may need to be used. When performing an undiluted vitreous biopsy, one can clamp the infusion line and aspirate using a 5 to 10 cc syringe directly from the aspiration line of the vitrectomy probe. Downsides to this approach include creation of intraocular hypotony that can increase the risk of choroidal hemorrhage. Alternatively, as demonstrated by Dr. Haider, an undiluted vitreous biopsy can be performed by infusing air during the vitrectomy. Either way, it's important to keep the vitreous cuts per minute at a low level typically less than 1,000 cuts per minute to decrease disruption of fragile cells by the cutting strokes of the detractor. Aspiration should be performed manually and can be performed either by an experienced surgeon or by the surgeon themselves with the assistance of chandelier illumination. Again, we want to thank Dr. Haider for sharing this technique of obtaining an undiluted vitreous specimen.

- **Floaterectomy**

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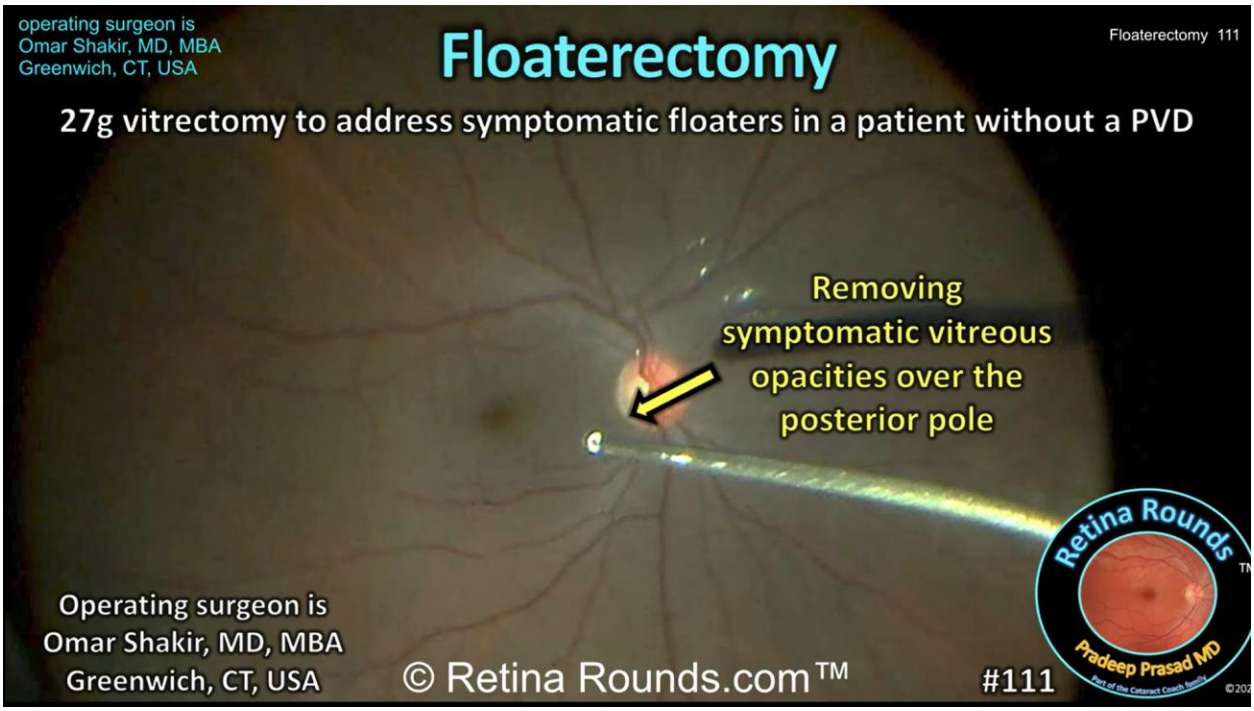
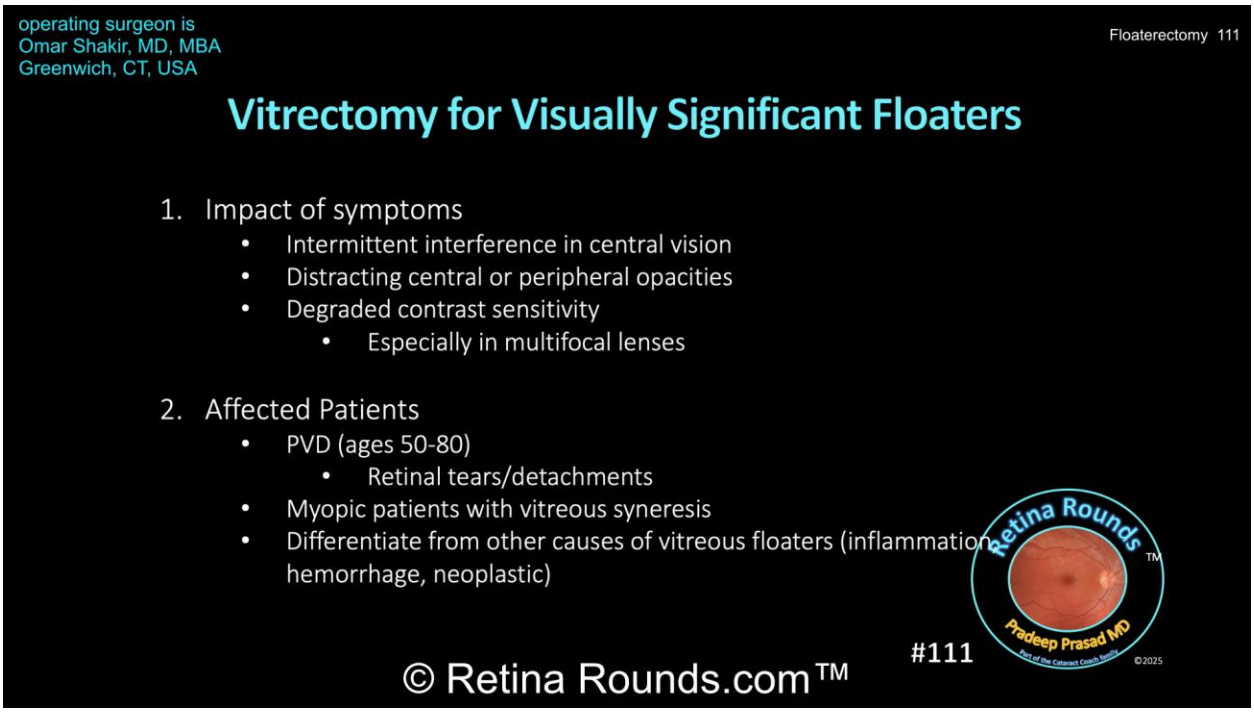
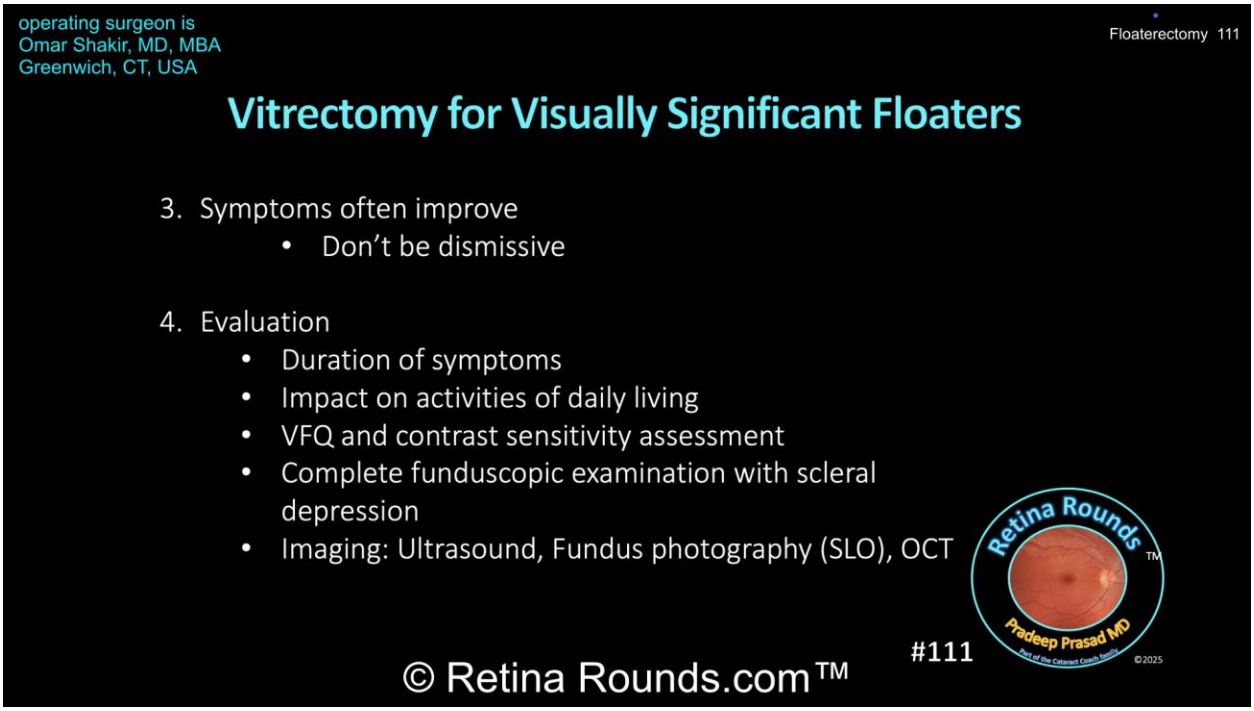


Vitreous condensations causing floaters are common, particularly in patients with a PVD. While the vast majority of patients can be observed, floaters in a subset of patients can be visually significant, interfering with daily visual function and activities of daily living. In today's case, guest surgeon Dr. Omar Shakir performs a 27-gauge vitrectomy for a patient with symptomatic floaters that are interfering with work duties. At the end of the case we will discuss the evaluation, management options and surgical considerations for patients with significant vitreous floaters.



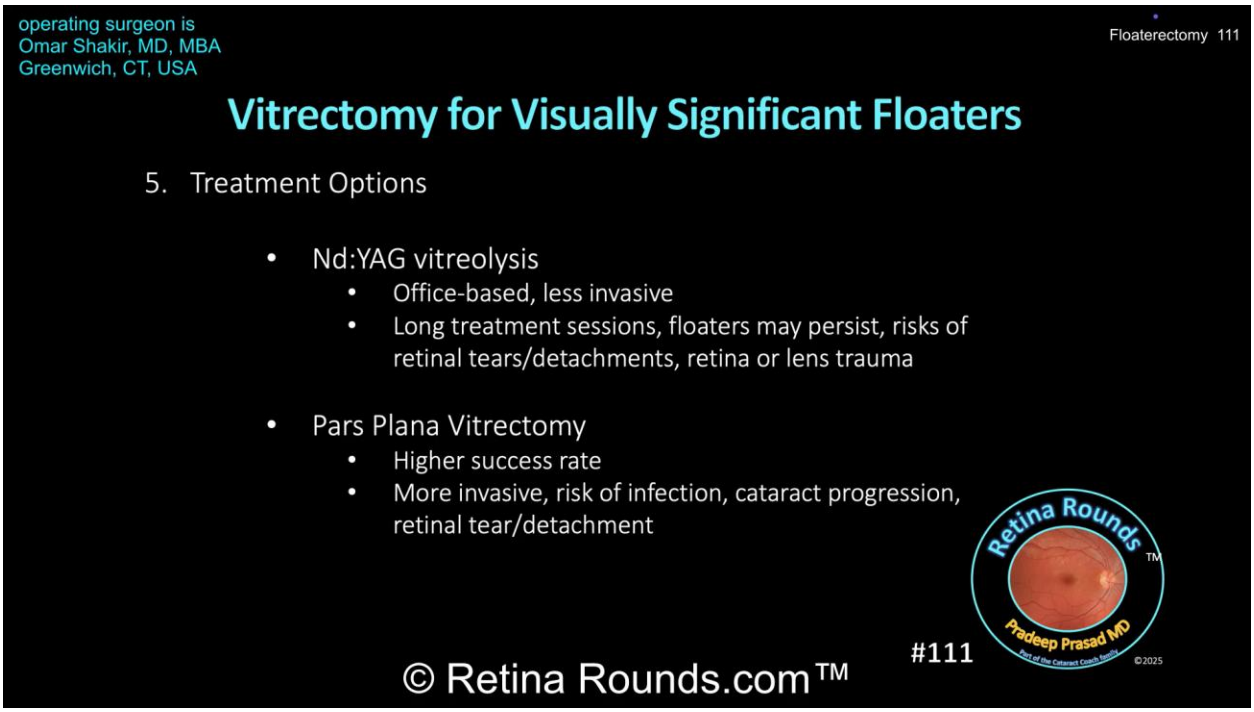
Here's some points for discussion. Now vitreous floaters can cause a number of symptoms. While most patients may notice floaters intermittently and are not significantly bothered by them, some patients can have significant symptoms including intermittent interference with central vision, distracting central or peripheral opacities, and degraded contrast sensitivity. This can be amplified in patients who have multifocal lenses that can also degrade contrast sensitivity. Now, most patients with symptomatic floaters will have a PVD and typically this is going to happen in patients aged 50 to 80. In addition to PVD associated floaters, they may also have retinal tears or detachments which needs to be ruled out and treated promptly. Patients without a PVD may also experience symptomatic floaters due to vitreous syneresis and these patients tend to be myopic. As always, it's important to differentiate floaters associated with vitreous degeneration from other causes of floaters, including uveitis, hemorrhage, and neoplastic processes such as lymphoma.



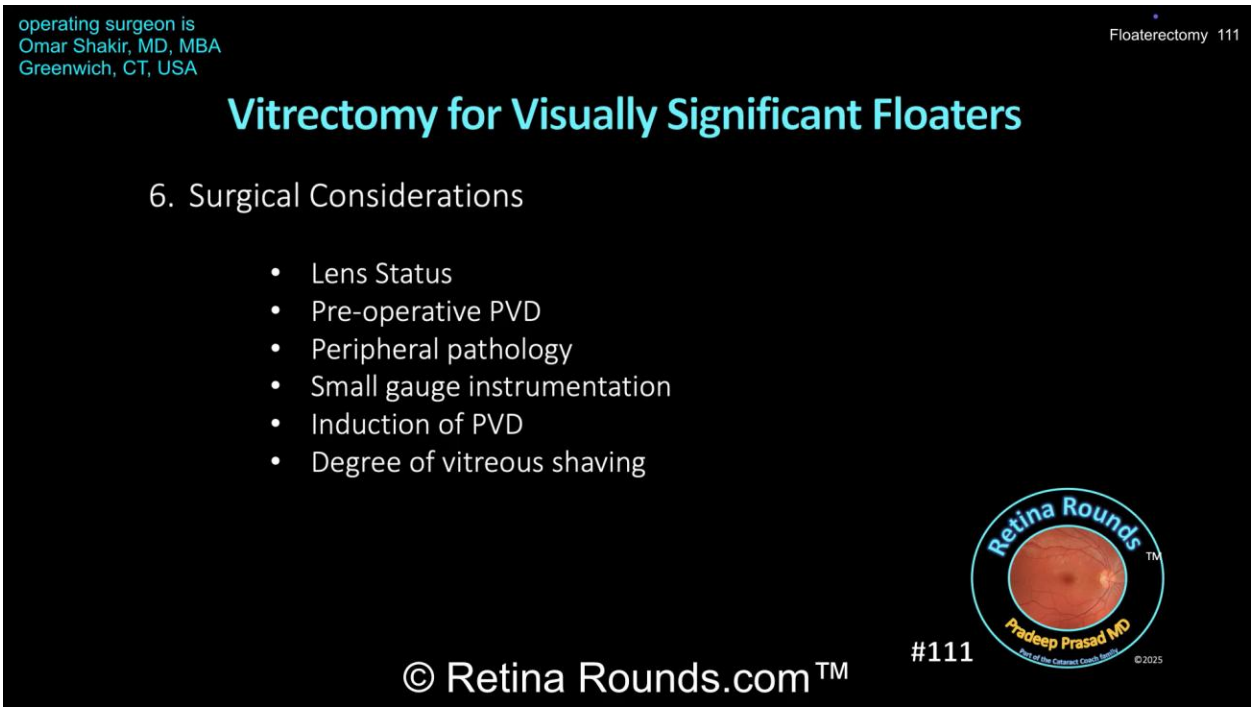
As many of you know, symptoms associated with vitreous opacities often improve. Ongoing liquefication of the vitreous may allow opacities to fall outside the visual axis, or patients may simply get used to it, also referred to as neuro adaptation. As a result, patients with acute onset of symptoms after a retinal tear or detachment has been ruled out should be reassured, educated on their symptoms, and observed. At the same time, it's important not to be dismissive of patient's symptoms. Patients want to be heard and once they understand the reasons behind their symptoms and the typical natural history, they're often content to wait it out and return for worsening symptoms. On the other hand, patients who have significant symptoms persisting more than 6 to 12 months warrant consideration for intervention.

When evaluating patients with symptomatic floaters, you want to get a thorough history. For example, how long have the symptoms been present and how and to what extent are the symptoms affecting the patient's daily life? Measures of visual function can also be helpful to identify those patients who would be good candidates for treatment. Snell and visual acuity while

necessary for every patient evaluation is often not enough to evaluate the impact of vitreous floaters. Visual function questionnaires and contrast sensitivity measurements can be helpful to assess the visual impact of floaters. Now it goes without saying that a complete ophthalmic examination should be done and fundoscopic examination should include scleral depression to identify any peripheral pathology that needs to be addressed. Imaging can also be very helpful. Ultrasound can help to visualize vitreous opacities and even objectively quantify the degree of vitreous density. Fundus photography especially those cameras that use scanning laser ophthalmoscopy can help to identify visually significant floaters. OCT can help to determine whether the vitreous is detached. Also, the live infrared video that you see during OCT acquisition can also be helpful to visualize floaters.



When the decision is made to treat symptomatic floaters, there are two main options. One is Nd:YAG vitreolysis, which can serve to break up large floaters into smaller, less bothersome fragments. The advantage to this approach is that it's office-based, less invasive than surgery, and multiple sessions can be performed. The downside on the other hand is that laser sessions can be long and accurately targeting floaters with the laser can be challenging since they can move around. Furthermore, floaters may persist even after Nd:YAG vitreolysis. Retinal tears or detachments may occur and the laser may cause damage to the retina or lens depending on where the laser treatment is rendered. The other option is vitrectomy which can be a more definitive treatment but is more invasive and is associated with known surgical risks including infection, retinal detachment and cataract progression.



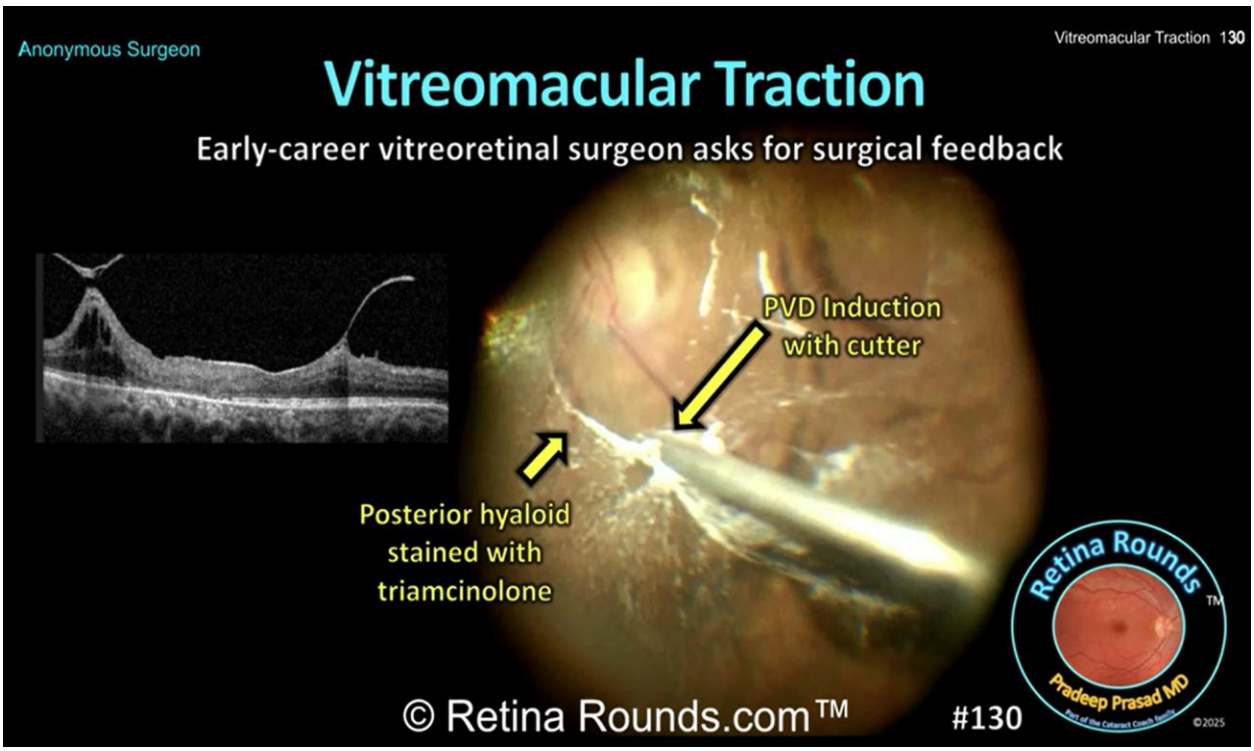
Here are some things to consider with surgery. Is the patient phakic or pseudophakic? Is a PVD present? I generally perform this surgery on patients who are pseudophakic with a PVD while other surgeons don't use this as strict criteria for surgical intervention. Is peripheral pathology present? One may consider prophylactic laser photocoagulation prior to vitrectomy to decrease the risk of intraoperative or post-operative retinal detachment.

Generally smaller gauge surgery is preferred either 27- or 25-gauge vitrectomy. Now one key point highlighted in this case is whether or not to induce a PVD. I generally don't perform these surgeries on patients who don't have a PVD. My inclination in these cases is to surgically induce a PVD to avoid post-operative vitreous contraction that may cause a tear or cause floaters to recur. Other surgeons take a more minimalist approach and that's what's demonstrated by Dr. Shakir where the PVD was not induced and the patient is was counseled on the potential for new floaters when the PVD does occur.

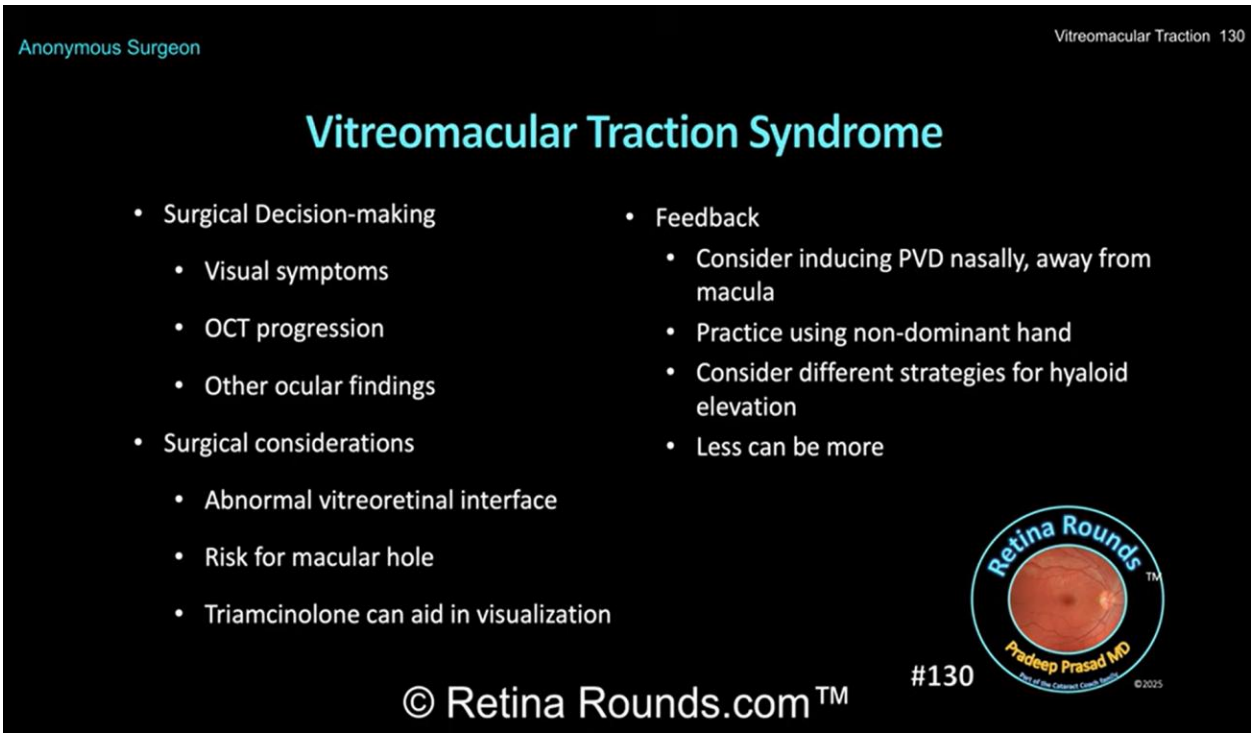
The degree of vitreous shaving also varies among surgeons. I generally favor a complete peripheral vitrectomy with shaving of the vitreous base. Other surgeons prefer to leave some anterior vitreous in place which may decrease the risk of cataract progression in phakic patients. Whatever your surgical approach is, it's always important to proceed cautiously when performing vitrectomy. Watchful waiting is often the answer. But for patients who may need surgical intervention, it's important to carefully weigh the pros and cons of surgery and patient specific factors both with respect to anatomy and the patient’s expectations. Some patients may still be unsatisfied following vitrectomy. Knowing the patient and making sure they fully understand the risks and benefits of surgery is critical to ensuring patient satisfaction. Now, thank you Dr. Shakir for sharing this case and for giving us an opportunity to discuss surgery for vitreous floaters. Thanks for watching.

- **Vitreomacular Traction**

Link: https://www.youtube.com/watch?v=IaaporscF0U&t=29s



Retina Rounds has been receiving videos from vitreoretinal specialists asking for tips and feedback on their cases. Today we will feature one of these videos from an early-career vitreoretinal specialist. The surgeon's patient has vitreomacular traction syndrome which proves to be a challenging surgical case. We we want to thank this surgeon and others for sharing their cases for feedback. Part of growing as a surgeon involves critically appraising one's own surgeries and getting feedback from colleagues can also be very helpful. So let's check out this case together and if you have any suggestions or tips, please be sure to add them to the comments section!



Here's some take-home points. When dealing with cases of a vitreomacular traction, one has to consider the patient's visual symptoms, the anatomic findings, their progression over time, and any other ocular findings like in this case PDR and asteroid hyalosis that have to be considered when planning for the surgery. Remember that patients with VMT have an abnormal vitreoretinal interface posteriorly, but often they have abnormal adherence peripherally. So, you have to weigh the pros and cons of how aggressive you want to be with removing the vitreous against the risk of creating a retinal break.

VMT and particularly those with focal adhesion over the fovea are at risk for macular hole formation. So PVD induction away from the macula particularly nasally can help to minimize traction during PVD induction over the macula and therefore hole formation. Now last triamcinolone staining can be a useful adjunct to make the surgery more efficient. With respect to this particular surgeon, first I want to congratulate you on a very nice anatomic and functional outcome. In addition to inducing the PVD nasally away from the macula, the one thing I would recommend doing is to practice more using your non-dominant hand since the elevation of the temporal hyoid in this case probably would have been more efficient with a vitrectomy probe in the left hand. Now less can be more and I think your ultimate decision to simply trim back the residual vitreous after multiple efforts to propagate the PVD was reasonable and probably the safest approach. For the retina rounds community, if you have any tips for the surgeon, again, please leave your feedback in the comment section. For the surgeon, thank you again for sharing this case. For any other surgeons, if you would like to submit your cases for feedback, please do so on the retina rounds website. Thanks for watching.

The journey of learning in vitreoretinal surgery is a lifelong endeavor, one that grows with every case, every discussion, and every shared experience.

Retina Rounds was created to serve as your opening key to this journey, offering foundational insights, practical pearls, and real-world lessons that will guide you through the early stages of your fellowship and beyond.

Our work does not stop here. New educational content and case discussions are uploaded regularly to Retina Rounds Channel, continuing to expand the learning experience day by day.

We sincerely hope that this book becomes not only a trusted companion during your fellowship but also a solid base upon which you continue to build your surgical skills, knowledge, and confidence.

With gratitude and best wishes,