

Vision as We Age: Understanding Common Eye Conditions

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Transcript

[0:00 Overview of the roles of various eye care professionals]

Dr. Nina Ahuja: So, in terms of an overview of eye care professionals, part of the reason there's so much confusion is that our names are very similar. We refer to them as the three 'Os' in our world: optician, optometrist, and ophthalmologist. Primarily, there are differences in what we do. In terms of our training, there are differences in duration and also depth of knowledge and experience that we have in terms of being able to recognize, diagnose, and treat medical and surgical diseases of the eye.

Now, if you think about opticians, I always say, think about somewhere like Lenscrafters. When you walk in, you see this display of frames. The optician will help you select the frames. They'll also help you fit glasses when they've received the prescription from the optometrist to make sure that everything is aligned so that if you have progressive lenses, for example, or bifocal lenses that help you see distance and near and things in between, depending on that lens design, the optician will actually help to make sure that everything is lined up properly so that when you're looking through the different portions of your glasses as you're actually seeing what you're intending to see, whether it's watching a movie at a theatre, at your distance, whether it's on your computer for your intermediate distance, or whether you're looking at something up close. So the optician is very, very instrumental in the execution phase, a very important role so that when optometrists write their prescriptions for glasses or contact lenses, the optician is the one who actually makes it happen for us.

The optometrist is, again, another very significant partner in the eye healthcare team. The optometrist is a Doctor of Optometry. They've done an undergraduate degree as well as a four-year degree, four to five-year degree following the undergrad, looking at eye diseases and specifically looking at how to recognize and diagnose eye conditions to a certain point so that anything that is front line is something that they can manage. With changes that have happened in the scope of practice in optometry, they're now able to prescribe certain medications as well, which was really helpful to us as ophthalmologists because there is such a need for eye care provision in our society as the population is aging, so that the more we can utilize one another's expertise and co-manage conditions, the better it is. The way that you can remember it at a very simplistic level because optometrists have a large scope of what they do as well, is when you go to the optometrist, and they put that big thing in front of your face, and they say, 'Which is better? One, two, one, two'. They're checking to see what lens in terms of a refractive correction or a refraction correction with glasses, what can help you see better. That is sometimes what we most anchor that role to. Again, they do much more than that. However,

that's something that you can help keep in mind as compared to the Lenscrafter's visual that I was giving you for opticians.

Now, when it comes to ophthalmologists, which is what I am, the degree of training is, again, more extensive. We are medical doctors, so we have done medical training in all systems of the body. We are graduates of medical school, so we hold an MD degree. Then after that, we do a number of years of specialty training, minimum of five, sometimes more, if you go into subspecialty areas within ophthalmology, so that we're really the experts or the final point in line to deal with advanced medical and surgical diseases of the eye in order to be able to really try to recover, cure, heal, support your vision so that it doesn't progress in whatever condition that it has, and in those cases where we can actually treat a condition, then we're able to do that as well.

So, it's a very interprofessional team that we have between all of us, from the optician to the optometrist to the ophthalmologist. It's a really beautiful system where there's a lot of co-management that happens, as I mentioned, which basically means that patients that I have and optometrists have, we are actually taking care of patients together so that when it's something that's of their area of expertise, I'll often have the optometrist follow along patients for routine checks and initial phases of care. When things become a little bit more advanced and require deeper interventions, then the optometrists will communicate with one another and take care of you all that way. Then, of course, like I said, the opticians are very instrumental in that as well in terms of making it happen with contacts, glasses, prostheses as well for people who have artificial eyes, the shell that we see that looks like the fellow eye, opticians are very much involved with that, too. That's overview of the eye care team that is involved in your care.

[4:40 How the eye works]

Dr. Nina Ahuja: Now, to move on to how the eye works, to set a little bit of context, the way that I like to present this is, first of all, we'll share the anatomy with you, and then I'm going to give you a more practical analogy that you can relate to. So, if you think of the eye as a ping pong ball, it's hollow on the inside, and the inside of that hollow piece is filled with something like clear Jello. The inside lining of that ping pong ball is like the film of a camera, that is what we call the retina, which is the bundle of nerves or the network of nerves that receives the images from light that passes through the surface of the eye, through the lens, and focuses onto that retina or the film in the back of the eye.

So, the analogy I like to share with this is to think of a Pentax camera. For those of you who are perhaps of the younger generation, you may not know what a Pentax camera is since everybody's using their smartphones and iPhones these days to take photos. The Pentax camera is like a 3D structure. It's a thing that you actually used to manually, depending on the type of model you had, you would manually adjust the focus to make the picture very clear. I like this analogy because if you think of the lens cap, which is not in this photo, but imagine there being a lens cap which is clear, light passes through that lens cap, it hits the lens itself, which is then adjusted by muscles in the eye and simply by the anatomy of your eye, and that light then gets focused to the film, which is where the image gets captured. Then from there, you can imagine a cable

attaching the camera to a TV, and that's analogous to the eye sending images and messages back to the brain so that we're actually able to process that information and see. So, as we move through, we're going to basically be looking and coming back to this picture and this analogy quite often because I like to use it when we're talking about different types of eye diseases in terms of context of what part of the eye we're talking about and what the implications are. This is, again, just that representation of the eye itself with the optic nerve, which is that cable I was talking about connecting the camera to the TV or the eye to the brain.

[6:45 What is age-related macular degeneration?]

Dr. Nina Ahuja: Getting into common age-related eye conditions. The first one I'd like to talk about is age-related macular degeneration. This is a significantly impactful visual condition. If you take a look at that photo that I was just referring to, you're looking at the film of the camera, which is that inner lining or the retina. Now, as you can see, the light focuses through the lens of the eye, and it gets focused to one point in the back of the eye, which is what we call the macula. That is why we refer to this condition as macular degeneration.

Now, if we look at what exactly this is, basically, number one, it's the most common cause of vision loss in Canadians over 60 years old. And what happens is that the cells that help you see are breaking down and deteriorating. So that if we were to look at the point to which that light is coming in that past photo, think of that area as having a lot of workers that are trying to clean up and maintain the health of that particular area. And what happens is that they don't work as well, they start to actually deposit waste, and then that diminishes the health of that area and affects the way that you see.

Now, the grid that you see on the right-hand side, I call it a crossword puzzle grid, even though nothing's blocked out, that is basically a representation of what that grid looks like with someone who has normal vision. But once you have that area of the eye being impacted and you have those deposits of waste and the breakdown of the health of those cells that are helping us see, you actually start to get distortions in your vision such that if you are looking at someone or looking at someone's face, you can't see their face necessarily, but you can see the surround. So that if you're looking at this photo that's above these grids, you can see the people, but you can't necessarily see their faces in detail. And the more that that progresses, the worse that gets. One of the ways that you can screen for yourself is to look at the crossword puzzle in the newspaper or to actually get one of these grids from your optometrist or ophthalmologist or actually, you can even get them online and download them, and to have that on your fridge and every so often, just cover each eye and see if there is this distortion that's developing. If it's developing in a way that is severe, you will notice it. So that is something that you can keep in mind for yourself when it comes to screening.

Now, there are two types of macular degeneration. There is the dry kind, which is what about 90% of people with macular degeneration have. That is where the factory workers and the cells that are keeping things clean are getting tired; they're not working so well, and you're getting those deposits of waste. That can or cannot impact vision. It depends on how much waste is accumulated and how long this has been going on for. And then there is the wet form, which is

about one in 10 people with macular degeneration, where that area that is no longer healthy actually has breakdown in structure. You start getting these abnormal blood vessels growing into those spaces in an attempt to work its way through and perhaps try to help heal the situation. But it actually ends up causing more damage because these vessels are weaker. They tend to bleed. You can get a scar. And then that central vision loss that is depicted in this photo just gets to be denser and denser. So, these are the two different types of macular degeneration that you have. People who convert from dry to wet, they actually can have sudden loss of vision with those bleeds. And so that is an event that needs to be looked at sooner than later so that we can actually treat those.

Now, in terms of causes of macular degeneration, genetics is a big one. If you have a family history, you do have an increased risk for this. That aging, just by the way, by the fact that, as I mentioned at the very beginning, everything gets a little older, gets a little sore, doesn't work as well necessarily as we get older. So that's certainly a risk factor. Environment as well. If you don't use eye protection, UV light rays can penetrate. They don't usually penetrate that far back, but they can have an impact depending on the nature of your job, for example, as well. That can have an impact if you're a welder and that can have multiple issues contributing to your eyes.

And then nutrition as well. We want to make sure that you have enough antioxidants, healthy, green, leafy, colourful vegetables that carry those items and nutrients that really do help maintain the health of those cells that are trying to maintain the health of the cells that help us see. In terms of risk factors, from a holistic body sense, blue eyes are at higher risk because there's not as much pigment in that color part of your eye, which is called the iris, to help filter light.

Cardiovascular blood vessels, we know that the blood vessels in the eye are amongst the smallest in the body, so that things like high blood pressure, cholesterol, heart disease, they all do impact the circulation to the eye, and therefore can have an impact on whether or not enough nutrients are reaching the eye.

Smoking as well is a risk factor. Studies have shown in the past that people who smoke have a five times increased rate of progression of macular degeneration. And again, family history, as we mentioned when we were referring to genetics. And the genetics aspect also does reflect in the cells' abilities to maintain the health of those parts of the eye that are responsible for that central vision.

Now, in terms of treatment, for dry macular degeneration, there's not really anything concrete. However, in terms of treatment per se, but there are measures that appear to be preventative. Vitamin regimes based on the age-related eye disease study are thought to be very helpful in decreasing the rate of progression. They are available in the pharmacies. There are two types. There's the AREDS and the AREDS2. For smokers, we recommend the AREDS2 formulation that does not have the same elements as the AREDS formulation, which was actually thought to increase risk of lung cancer in smokers so that they had actually developed a formulation for smokers, so that if you are a smoker and you are at risk for macular degeneration, you've been advised to take these vitamins, I would make sure that you're taking the kind that actually is for smokers.

In terms of wet macular degeneration, there are certain indications for injections to the eye that basically the idea is for those abnormal blood vessels to be discouraged from growing so that the idea is if we're able to discourage those from growing, we don't have those fragile blood vessels that are likely to leak, bleed, and cause scarring and permanent vision loss. So, about 90% of eyes stabilize with the injections. The number of injections required is variable depending on the case that is guided by the ophthalmologist's discretion based on objective testing. And up to a third of eyes actually improve. So that there is value, particularly if you catch it early on to have this sort of treatment. That's where your retina specialist will guide you through that process to decide exactly what is appropriate for you and how best to approach your condition.

So, as I mentioned, in terms of prevention, you want to monitor your changes in your vision. That's where the grid comes in very handy. You want to make sure you're maintaining your nutrition. Get regular exercise. Again, that's good for cardiovascular health. That's good for all vascular health. Quit smoking. Wear UV-protective sunglasses. The broad spectrum are great so that you can actually see those glasses that are labeled with UVA, UVB protection. You want to be 100%, and that will help maintain the overall eye health, including preventing or not encouraging the progression of cataracts, which we'll be talking about next.

[14:40 What are cataracts?]

Dr. Nina Ahuja: So, moving on to cataracts. If we go back to that photo again, as we saw, the light passes through the surface of the eye, and it gets focused by the crystalline lens. So that's the structure that we're talking about. It gets focused to the back of the eye so that if we look at the camera analogy, the lens portion is what is being impacted here, not the film of the camera, not the lens cap. So again, we're looking at the crystalline lens. This is the area here that we're considering. Now, in terms of cataracts, what's really happening? Basically, it's the natural lens in your eye becomes cloudy. So we're all born with a lens in our eye, and that lens is made up of various proteins which, over time, break down so that if you think of your natural lens as a clear window, over time, that window becomes cloudy.

And so, if you look at the picture on the right-hand side at the two kids with their balls, the soccer balls and whatever ball that is, it's a pseudo soccer ball, I'm not sure. Anyhow, the vision just gets generally cloudy. So that if you're elderly, on certain medications, you have certain systemic conditions like diabetes, for example, you were born with cataracts, which could be another cause or risk factor, if you were ever hit in the eye and that's triggered this change in the proteins in your lenses, if you have a family history of early cataracts, if you're a smoker, again, exposure to UV rays, you see this gradual progression of the lens of being clear where you can't see anything. It's like you're looking through a clear window into the dark space of the eye without it being illuminated to having this white reflex in its advanced cases where the proteins have evolved so much that you can't see through it. You're really looking through a dirty window to the extent sometimes that you just can't even see through the window.

Now, in terms of symptoms, what you're looking at is blurred vision, as it was depicted in that photograph. Difficulty with night vision because what's happening is the light is being scattered in all directions instead of to that fine point. You can have light sensitivity as a result as well, getting glare and halos. Double vision, just because the way that the light passes through, you

might feel as though there's a ghosting image. This is separate from seeing two images. So, if you see a car and you see distinctly two cars, that's not the type of double vision I'm talking about. That is a separate entity relating more to the muscle function in the eye. But this is where you're looking at something and you see a little ghost behind it or beside it. If you're looking at the grid lines, for example, they may be straight, but you might see a little shadow of one above the line. So that's what I mean by the ghosting image. Fadings of colors. I often have people who have cataract surgery who say, the world is so bright. I didn't realize how dim it had become. And you need more light when reading. So, these are some of the common things that you can look for. And depending on how advanced your cataract is, your symptoms will be more or less on the scale of not bothering you at all, bothering you extremely, depending on which of these symptoms you're exhibiting at the time.

So, in terms of treatment for cataracts, it really does come down to surgery. Some questions have come up in the past about supplements and do they cure cataracts? The literature, there is no evidence so far. So, the research that's been done, there's no evidence that supplements actually reverse cataracts. However, there is a thought that there may be possibilities that with some of the antioxidants that are also similarly used for macular degeneration, for example, may delay the progression of cataracts or the development of cataracts. So that's where, again, all of those things in terms of healthy eating and exercise and lifestyle factors become, and UV-protective sunglasses, all of those things become important.

But once you had a cataract, really, the treatment right now is surgery. So, in terms of how surgery is done, I like to use the analogy of a Smartie. Again, if we go back to, I think people are familiar with the candy-coated chocolate. If we look back to our anatomical representation here, you've got your Smartie, quote-unquote, standing on its side attached to the eye with a bunch of strings around it. And again, this is just a two-dimensional view, but you can actually think of that lens or cataract as being like a Smartie. When I talk about the surgery, I always give the analogy of the candy coating being more like a clear Saran Wrap case, and the chocolate is the cataract itself. That's the protein that's changed over time so that the lens has become more dirty or darker in nature, inhibiting your vision. So that in cataract surgery, what we do is we open up one side of the candy coating, we take out that disk of chocolate after mobilizing it from the inside of the shell, and then once the shell is empty, we inject an intraocular lens into that space that takes the space and takes the place of the original lens that was in your eye that was doing the focusing for you.

Now, a common question is the intraocular lens, this is, again, it going into that case, which is that clear candy-coating case with the one side open, so we can actually get the lens in. The question is often do we have to put a lens in the eye? And the answer to that is that we do because if we look at the way light is focused as it passes through the eye, you do have some focusing power in the cornea, which isn't depicted here because the majority of your focusing is happening at the lens. But if we don't put that in, you actually don't have anything focusing the light back to that one spot. And so, if you remember many, many years ago, lots of people were walking around with really, really thick eyeglasses. The reason for that is because they didn't have that lens put into the eye. There are issues with these lenses, these types of glasses, because of the weight. At that time, a lot of them were only available in glass. And a lot of these thicker types of glasses caused distortion in vision as well. So even though people may be uncomfortable

sometimes with the idea of having something foreign in their body, or as an implant in their body, this is a very neutral material which is well tolerated. Basically, no reports of allergy. You may have some sensitivity to it, but not in North America, usually in some areas where the manufacturing processes are a little different than we have in North America. So that having an intraocular lens is an essential part of the cataract surgery unless there's some reason that comes about in surgery where it's not safe to put one in. And that's our call as surgeons in the surgery, in which case we will then talk to you about it later and see what we can do to best manage your vision and put in an intraocular lens in a different way.

Now, one of the things that is really talked about a lot when it comes to cataract surgery is you have these intraocular lenses. There is such a variety of them, and the surgery is done in both public and private centers. So how is all of that addressed and what are the differences in that? That is a very deep conversation, but I did want to address that at least at a high level because it is such an important and timely topic, especially with the shift of cataract surgery moving into private centers, still being done in hospitals as well, but definitely, the private center space is becoming one that is expanding by policies that are being put forth by provincial governments.

Now, in terms of the private versus public, your cataract surgery is covered, whether it's done at the public center or in the private center. But where the difference has really come in is the technologies that are available at the various centers. So, if we were to, I'm going to come back to that via this explanation, if we were to look at the different intraocular lenses and cataract surgery, there are many of them. There are so many of them that even for me, as a surgeon who's been doing this for 20 plus years, it's sometimes hard to keep it straight, especially since so many advancements have been coming up in the last probably 5 to 7 years, especially. So, the way that I like to think about it, and the way that I think is helpful for you to think about it, is to look at the various distances involved in your vision. So that you've got near vision, which, of course, is like your pill bottles and your books. Your intermediate is more the computer distance. And then you've got your distance vision, which is if you're watching TV or depending on how far your TV is, assuming it's far, or if you're going to the theatre or you're watching a movie at the theatre, or you're just driving and looking into the horizon. Those are the three levels or three primary ranges of vision that we're looking at.

Now, in terms of what's available in hospitals and everywhere, your standard lens is basically looking at correcting your distance so that you can try to target near or intermediate, specifically, but those lenses only allow for one focal point or one distance to be clear or to have that clarity. So that when you're planning the surgery, the monofocal lenses, which are standard of care, are basically limiting you to one area of distance so that you can see that well. You may need glasses still. Most people still need glasses after surgery because as much as we plan, theoretically, everybody heals differently. And so, the glasses help support the work that's been done in surgery.

Now, if there are other lenses, though, that have come out on the market that are a little bit more advanced, and they are able to cover the distance, which is, again, far away horizon and intermediate, which is computer. Now, not all hospitals offer all varieties of this particular family of lenses. And so that's where the private centers do offer greater variety of these lenses extending into intermediate vision and also extending into near vision. So that the

differences between the public centers and the private centers are largely in the range of vision that's offered in the lenses and the degree of variety that is offered for each of those models in each of those categories.

So, there are some hospitals that do offer these advanced lenses, but there are many others that don't. And that's simply a function of what's available through contracts often, because there are contracts that are between hospitals and suppliers that help to guide what can be used at a hospital. The other thing is, too, is diagnostic testing. Hospitals don't always have the funding to be able to house on site the latest and most advanced comprehensive package of testing. The private centers also offer that. And so you always have the option of having everything done under OHIP. But if you're interested in learning more about these new technologies and the variety of lenses that are available, the private centers are where you can often be assessed, be informed, be educated, make your decision, and then decide to have your surgery any which way you'd like, whether it's in the hospital setting or in the private setting. Those are a few really important distinctions. Depending on which type of lens you're looking at, you're looking at variability in cost. So that it's like if you're buying your basic model, well, then that's going to be covered by OHIP, the degree of upgrades you want, there's increasing costs, there's more touch-up opportunities and long-term care follow-up that's available with these. So just to clarify that confusion a little bit, because that's a very, very common question that I get in my practice as well. These are some of the things that are available to you in public versus private. Nobody's ever going to force you to do anything. It's purely a matter of being educated and then making the decision that you like. So, distance is what we call monofocal. Then when you're getting into the varying degrees of distances and ranges of vision, that's when you're getting into the more advanced technologies.

So, we've covered so far an overview of eye care professionals, how the eye works, and we've touched on the first two common age-related eye conditions, age-related macular degeneration and cataracts. So, we will move on to the next. I just wanted to do a recap because we've been through quite a lot already.

[26:24 What is glaucoma?]

Dr. Nina Ahuja: Moving into glaucoma. Now, glaucoma is a condition that if we come back to this original photograph, we're looking at the plumbing system of the eye itself. So, there's not really an appropriate area on the camera, per se, for this analogy. So, we'll pull away from that a little bit. But I will keep it on screen because what it does do is it does pull in the optic nerve, which is the connection between the camera and the TV or the connection between the eye and the brain. So, that when we're looking at glaucoma, what happens is it's a condition where we are looking at the drainage system or the plumbing system within the eye itself not working well, and so what that's doing is it's causing damage to the optic nerve, which is where all of those nerves that are receiving images are going back to the brain in order to help us see. So, if you have damage in that area, you're not getting as much transmission, the quality of your vision decreases, and I'll show you what that looks like in a second.

So again, if we look at the plumbing system of the eye, you do have fluid being produced in the eye, and this is where your pipes are, so to speak. If you think of it as a steady intake of water, which is an internal intake because it's being produced back here. It's a type of fluid that has various nutrients in it. It is actually produced, and then it flows out of the piping system here. And over time, you can have blockage buildup, you can have various issues with that so that you get the pressure buildup in the eye, which then again translates into nerve damage, which then impacts your vision.

So, if you're looking at what it looks like to have glaucoma, you can see that as you're progressing in severity, it's actually moving in towards more and more tunnel vision. And for those people who have very advanced glaucoma, it can actually just shrink to such a tunnel and then disappear. So, that it's a very important condition to pick up early. It is not symptomatic. Often people don't realize they've hit an advanced stage of glaucoma until they've seen an eye care professional, an optometrist or ophthalmologist, had their vision checked and then had some visual field testing done, which if any of you have had that, that's the machine where you kind of put your face in there and they either bring in an object that you tap when you see it or a light flashes and then you tap when you see that. That is a visual field test. It is in only extremely advanced cases where people will realize that 'Oh, I'm trying to drive, and I really can't see to the side if I'm looking straight ahead'. So, that these are things that are regularly monitored, though, so that you can be reassured that when you are seeing an optometrist or an ophthalmologist, we are checking for this at every exam, so that it's important for you to maintain that consistency.

Now, in terms of types of glaucoma, again, we're looking at that plumbing system. You can have open-angle glaucoma where you have trouble, issues with the pipes, but the angle or the access to the pipes is still open. So, the inside of that lens cap and the surface of the iris or the coloured part of the eye, that's still open. That's open-angle glaucoma. You can have angle-closure glaucoma where suddenly this space collapses with the iris falling forward or something pushing it forward. So, it's like putting a plug into your drain. You just can't get anything out. But yet the fluid is still continuing to be produced. So, you have a sudden increase in pressure, and it just can't flow in and out through its inflow and outflow system as usual. And then you can have normal-tension glaucoma where you can have normal pressure in the eye where the system is working well, and yet you can still have damage. It's not as common, not as well understood. And again, it is something that is checked when you see your optometrist and have your visual field test screening, and then also with an ophthalmologist if you have some of the risk factors. So again, we're looking at the plumbing or drainage system here, and then the impact on the optic nerve leading to these vision changes more and more so as the disease progresses.

Now, in terms of risk factors, intraocular pressure is probably one of the largest risk factors. The higher your pressure is above normal, the more concerning it is. Usually, normal is less than 21. For someone who has glaucoma, it is targeted much lower than that. The lower you can go, the better it is for decreasing progression based on the studies. But of course, you want to maintain enough pressure so you don't change that beautiful globe of an eyeball into a little raisin of the grape, from a grape to a raisin because you've lowered the pressure so much. You don't have to worry about that. That is unless there's some trauma where you've got a cut in the eye

and a major cut from a major trauma, not just a little scratch on the eye, but if you've been in an accident and you've had an opening that has basically created an alternative path of that fluid to the exterior of the eye, those are concerns about the pressure dropping so low. But in the day to day, it typically does not happen.

Family history is also important. If someone in your family has glaucoma, you are at increased risk. And then certain ancestry, previous history of eye trauma, not the penetrating type that I was just talking about. So that the penetrating type is, say someone's in a car accident, windshield shatters, glass goes in the eye, it's penetrated the eye, it's created a cut, and therefore things that are not great, and you've got fluid and tissues coming out. This is more about previous eye trauma where, say, you were hit in the eye with a soccer ball, and there was some damage there that can impact the way that those pipes function. Long-term use of steroids. So, people who are taking steroids for asthma who have required that for a long term, that can actually increase your risk as well for glaucoma, and then, of course, increasing age, as we talked about before.

In terms of treatments, your treatments are really focused, again, in this area where the plumbing is. Eye drops. Actually, eye drops also decrease the inflow. So that's where your fluid is produced. It decreases the production of the fluid and increases the outflow in the pipes as well, depending on which drug you're using. Oral medications as well can be helpful. Laser treatment focusing specifically on those areas where the pipes are so that they can create spaces to allow more fluid to flow through. And then other types of surgery, which are basically redirecting away from the pipes themselves because they may not be working effectively or they just can't recover with all of these other treatments, so that the fluid is being transferred from the area of the eye, which is the anterior chamber, which is the blue section filled with fluid, so that it goes into another space on the eye, but bypassing the pipes to varying degrees. So, those are the different treatments that are involved in glaucoma.

[33:00 What is diabetic retinopathy?]

Dr. Nina Ahuja: Diabetic retinopathy, this is another common one. This is the last one we're going to go through before we hit some Q&A. When it comes to diabetic retinopathy, again, if we go back to that analogy of the camera, we're looking at the film of the camera so that, again, we're looking at the anatomy, we're looking at the inner lining of the globe, which is called the retina. We have a number of blood vessels. Well, it's not a number of them, there are so many blood vessels, but the eye is very, very concentrated in its circulation, and so what happens is when you get variabilities in sugars, you get damage to the linings of the blood vessels, which then become leaky. They become sensitive. They can have outpouches, which are called microaneurysms. You can have bleeding because of just the trauma of the blood circulating through and the weakness of the adhesions in the inside of the blood vessels, which are the highways that take the blood to the various parts of the eye. And you can have areas where the blood circulation just gets cut off, and those are what are called "cotton wool" spots in areas of what we call ischemia, where there's no oxygen getting to that because the flow of blood is just inadequate at that point.

Now, when you look at diabetic retinopathy, there are varying stages and varying degrees of it. People who have diabetes, if you have diabetes, it doesn't mean that you will have diabetic retinopathy, and we'll talk about what the risk factors are for that, but there is a progression of this condition where you can really have a severe vision loss that is treatable, but at times, it's an avoidable, it's one of the leading causes of preventable blindness. So that you can see here that as a diabetic retinopathy worsens, you get more and more changes where you've got leakage of blood vessels, you've got spots of blood, you've got accumulation of blood at various levels. This is actually evidence of some laser treatment, which I'll talk about as one of the treatments for this condition. And if things get very, very severe, this blood can actually fill the, you can have a large bleed in the eye, which can significantly impact the vision, and also cause scarring, which then can serve to start pulling that film off the inside lining of that, pull the film from the camera inside the camera, or if you're looking in the analogy of the ping pong ball, you're taking that inner lining and it's being pulled because of the scar tissue pulling the retina away from the globe itself. All of those things can lead to significant visual loss.

So, in terms of what you're seeing, it depends on the degree of what your vision impact is when it comes to diabetic retinopathy. So that if you have those splotches of blood, you can see that you're going to have those spots that are being blocked in your sight. If you have the blood that is floating, this is sitting here, but if it's floating where your view is a little bit more hazy, that's actually an early picture, but if you did have it such that it was hazy, then you're going to find that things become more hazy. If the damage is in the area where the light comes to that focal point that we've been looking at the macula, you can start to get distortions as well. So that there are lots of different types of things that can happen with diabetes, which are very, very impactful, can be long lasting, and people can lose their sight from that.

In terms of risk factors for progression, poorly controlled diabetes is a big one. That's why tight sugar control is really important. Cardiovascular risk factors, as we said, it's circulation related. So the healthier your circulatory system is, and your vasculature is, or all those little highways taking blood everywhere in your body, the better it is. Not realizing you have diabetes and it being uncontrolled for a very long time leading to damage, so late detection. And pregnancy as well can trigger progression of diabetic retinopathy so that it's important to be checked in the first trimester if you are pregnant and diabetic, and especially if you have a history of diabetic retinopathy to make sure that things are holding steady.

So, in terms of treatment, tight sugar control, as I mentioned, routine monitoring becomes really important. These are things and changes that you may not realize until it is very symptomatic and causing more serious damage. And then that's where regular eye exams become really important. So, the routine monitoring of your sugar and the regular eye exams as well.

In terms of more advanced disease, there are injections similar to macular degeneration, where I was talking about that injection that discourages the blood vessels from growing and bleeding simply by regressing the growth. That is why it is called anti-vascular, it's against the blood vessel. Those can be used in certain cases, depending on where the diabetic retinopathy is. Is it a leaky vessel? What is the problem? This is sometimes a solution for a leaky vessel that's abnormal. Laser treatment as well for those little outpouches and microaneurysms can be helpful.

And then vitrectomy is basically when you've got your ping pong ball and it's filled with blood because the inner lining has these abnormal blood vessels that are bleeding, and you actually go in and clean out the blood to reestablish that clear, it's no longer Jello, but in essence, that clear fluid that's in the ping pong ball or in your eyeball to allow that line of sight to be clear.

So in terms of prevention, importance of regular eye exams, we've talked about diet, nutrition for eye health, maintaining healthy blood sugar levels, making sure you're monitoring them, quitting smoking or never starting, again, that affects the blood vessel health, and then again, protecting eyes from UV light and strain.

So, that takes us to the end of the discussion, the active part of this presentation. So, we've talked about the overview of eye care professionals, how the eye care eye works, common age-related eye conditions and I would love to turn it to you, Dr. Levinson, for any questions that people may have or any thoughts or comments. Thank you very much. Oh, that. Yeah, thank you.

[39:23 What causes 'dry eye' and how can it be treated?]

Dr. Anthony Levinson: That was absolutely an amazing overview, Nina. There's a ton of questions. I think you did a great job of addressing so many of the pre-submitted questions, and there's more questions coming in. I'm going to try to focus on a few of the questions related to some other conditions first. So, one of the topics that came up quite a bit is, 'What are some of the common causes of dry eyes, and are there any specific treatments available for severe dry eyes?'

Dr. Nina Ahuja: So dry eye is a very, very common condition that happens for different reasons. One is environmental. So for example, at times of the year, when we've got the heaters on, we've got more evaporation happening so that that increases your symptoms of dry eye. Certain medical conditions as well. So, people who have autoimmune disease like rheumatoid arthritis, lupus, and others. There is an impact on the gland that produces the tears, and so it doesn't necessarily function as well. That can impact and cause dry eye as well. Certain types of procedures. So LASIK, for example, the refractive laser surgery to get rid of glasses, or even cataract surgery, sometimes not so much cataract surgery because the incisions aren't as large, but if you have had some procedure to the surface of the eye, that can increase dry eye because that severs the nerves, which are the messengers from the surface to saying that "the eye is dry, we need to lubricate more", you just feel those symptoms. And also very, very, very common is something called blepharitis, which is irritation at the base of the eyelashes. We have a number of oil glands at the base of the eyelashes that when those oils are released, they serve to coat the surface of the tear film, preventing evaporation. And for many of us, the natural healthy good bacteria on the skin actually is not maintaining, the health is not being maintained because the pores become clogged, and so that the oils that are being produced aren't as healthy.

What to do about that from a day-to-day standpoint is to take a face cloth, run it under warm water, do a warm compress in morning, at night. If you can keep that over the eye for 2 to 3 minutes, closed eyes, what that does is the heat serves to open the pores, and then to cleanse that

area by taking something like Johnson's baby shampoo, which is a no more tears formula, you just lather it up in your fingers and almost like you're shampooing your eyelashes and rinse it off, that helps lift up the debris.

And then a non-preservative or preservative artificial tears are also very helpful in keeping lubrication. For people who have sensitive eyes, I recommend non-preservative tears, non-preservative artificial tears, simply because, over time, those preservatives can cause some irritation, which leads to another cause of dry eye, which can be long-term use of drops.

So, for example, patients who are on glaucoma drops, that, over time, because they have preservatives, can also contribute to dryness.

[42:04 What are floaters and how can they be prevented or treated?]

Dr. Anthony Levinson: Several people were asking questions about floaters. What exactly are floaters and can they become something more serious? Are they a cause for concern? Are there any types of prevention or treatments available? And can they lead to other more serious conditions?

Dr. Nina Ahuja: Yes, so floaters are very common. They happen to pretty much all of us, some of us sooner than later, especially if you're someone who's very nearsighted as I am. I take off my glasses; I can see up close, but not at distance. We tend to be more prone to developing floaters sooner.

What it is, is if you think back to that analogy where I gave of the ping pong ball, where the hollow part of your eye is filled with a clear type of jelly. Over time, that jelly changes consistency so that you get little pockets that have become a little bit more dense, and we see those as floaters. Now, the concern is that in about 10 to 15% of people, those floaters can be indicative that there is a retinal tear happening. So that, again, going back to the analogy, that ping pong ball has this inner lining, which is like the film of a camera. The jelly is opposed to that. As it changes consistency, you get your pockets which are denser, the rest becomes fluid. That entire body of Jello shrinks and starts to pull on that inner lining of the ping pong ball. In areas of weakness, which not all of us have, but many of us have, that can actually cause a little tear. Some of the fluid of the gel, that has changed into fluid, that can sneak in behind those tears and actually cause a retinal detachment.

So that becomes really important because that's when that inner lining has lifted from the inside of the ping pong ball or the eyeball, which can then make it feel as though you've got a curtain that's pulled over your vision, you cannot see through it. That becomes really important to repair quickly so that you can have that placement of the inner lining back to where it belongs so that everything can kind of reattach in terms of the functioning in those nerves, really being able to take those images in and then relay them back to your brain. So that is a common thing, 10 to 15% of people with floaters have retinal tears, and about 40 to 50%, if you have a retinal tear that does not get detected, can actually progress to a retinal attachment.

Dr. Anthony Levinson: Well, that's an interesting comment, and actually was one of the other topics that had come up, people asking about the various causes of retinal detachment and how that's treated. And that's another one that is more of a surgical emergency, isn't it?

Dr. Nina Adhuj: Yes, it definitely is, and there are a number of causes. The mechanism that I spoke about is just the cause that happens with time and as things change. However, as we saw with diabetic retinopathy, if you have a lot of scarring that develops because of damage from that, that can cause retinal detachments as well. If you're in an accident, you have trauma to the eye, that can suddenly be a jarring effect that can cause those tears and lead to detachments. So, there are a number of different causes.

Common symptoms to look for are a sudden showering of floaters. So, not just a few here and there, but feeling as though there's a snowstorm in the eye, a lightning storm where it's flash, flash, flash, flash, and it just doesn't seem to stop, or the feeling as though someone's pulled a curtain over your vision and you simply can't move it away.

[45:18 How does laser surgery work? What eye conditions is it used for?]

Dr. Anthony Levinson: You alluded to LASIK surgery, and actually, there were a few questions that came in asking about laser surgery more generally. How does it work? Are there risk factors associated with it? How does it actually correct vision? And are there just generally about the or disadvantages of laser surgery?

Dr. Nina Ahuja: That's a great question. I think one of the things that needs to be understood, and the people need to be educated on, is that lasers are used for many, many different conditions in ophthalmology. An example is, of course, something like LASIK or PRK. Those are the procedures that are used to try to get rid of glasses for people who are interested in that. For glaucoma, we talked about how you can have problems with plumbing system in terms of the flow of fluid. If you have that narrowing of the angle, you can't access the pipes. So we can use a laser to create a little hole in the iris or the coloured part of the eye to redirect the fluid. In diabetic retinopathy, we can use the lasers to help close those little outpouches of blood vessels that want to leak and bleed. So, we use lasers for those things and even many, many more so that depending on what condition you're treating, the advantage has become very clear, simply because you're trying to avoid progression of disease.

When it comes to laser refractive surgery, which is getting rid of glasses, there are different advantages and disadvantages to that. It's very case-specific. In my work, in my approach, I'm a proponent of basically doing what you need to do for your function. So that if you need to have laser surgery because your profession requires it, well, then it's certainly something to look into. If, for some reason, you can't tolerate glasses or contacts, and it's too early for cataract surgery because your lenses haven't changed, that's certainly an option. Having said that there are other options for people who don't have cataracts that you can still correct your vision to get rid of glasses. Regardless, that takes us off the laser topic.

But in cataract surgery, there are also uses of lasers as well. The advantage is to those, and those are used in the private centers, is you've got those really accurate, repeatable, precise incisions that are made, which helps keep it very controlled from a healing perspective and from a surgical perspective as well.

[47:40 What can you do to promote eye health and prevent eye-related diseases?]

Dr. Levinson: Interesting. I wanted to close off with a couple of questions related to prevention. So, are there particular recommended screening procedures for eye health and diseases? What would you say? Just as an add-on to that, people also had a lot of questions around other preventative measures. Exercise, diet, or supplements. Is there evidence for the eye health advantages for some of those things that are helpful in other forms of disease, like heart disease or brain health?

Dr. Nina Ahuja: It's a great question. There's certainly evidence for maintaining cardiovascular health. So that exercise, healthy eating, all of those things are very positive. UV protection is also very important. The UV rays can penetrate the eye to varying degrees and cause damage over time if there's a prolonged exposure. Also, vitamin supplements for macular degeneration. We do have scientific evidence that supports that in terms of preventing and delaying progression, as I mentioned earlier.

There are other vitamins as well that are out there in terms of they're being talked about, like lutein, selenium, in terms of potentially preventing the progression or delaying the onset of cataracts and also maintaining general health. The studies are not robust in those areas. However, maintaining a healthy, balanced diet with green leafy vegetables will help you get what you need to do, what you need to be able to maintain your health. And also, things like omega-3 supplements, which can also be helpful in dry eye because there is thought to be an inflammatory component, so that, that along with the antioxidants that are in our healthy foods and in those AREDS2 or AREDS supplements, those all come together to really be able to maintain eye health. Lutein is a common one. That is a common antioxidant that's used in those cells that help keep things clean. There's a little bit more evidence on that, but it's not definitive as to whether or not this supplement versus that is absolutely beneficial.

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