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Advancing Myopia Detection and Treatment: A Look at Novel Innovations

Ryan Quigley:
This is *Eye on Ocular Health* on ReachMD. I'm Ryan Quigley, and joining me to discuss emerging technologies and therapies for myopia are Drs. Michael Twa and David Berntsen.

Dr. Twa is a clinician scientist and the Dean of the University of Houston College of Optometry. Dr. Twa, welcome to the program.

Dr. Twa:
Thank you, Ryan. Good to be here.

Ryan Quigley:
And also joining us from the University of Houston College of Optometry is Dr. Berntsen, who's the Golden-Golden Professor of Optometry and Chair of the Department of Clinical Sciences. Dr. Berntsen, thanks for being here as well.

Dr. Berntsen:
Yes, thank you. It's great to be here, Ryan.

Ryan Quigley:
So if we start off with some background, Dr. Twa, what recent trends in global myopia prevalence concern you most, and how do they shape the urgency for new technologies?

Dr. Twa:
Ryan, the trend that concerns me the most is the incidence rate. While prevalence is up around the globe, the incidence rate really shows a story of myopia accelerating globally, and that's the most concerning. I think while some of us are looking at a potential doubling of the prevalence of myopia over the next couple of decades, this really is going to drive not just an increase in need for glasses, but it's going to drive this higher global burden of disease associated with myopia. As myopia goes up, we know that glaucoma incidence goes up, macular degeneration goes up, and retinal detachments go up, so there are a number of other causes of vision loss associated with myopia, and those are the things that really concern me the most.

Ryan Quigley:
Now, Dr. Berntsen, when it comes to detection, how have advancements in diagnostic imaging and biometric assessment improved our ability to identify at-risk patients earlier?

Dr. Berntsen:
So myopia is interesting when it comes to that because we know from longitudinal studies that have looked at how we can best predict which kids are at the highest risk of becoming myopic, the answer is very simple: it's based on how old the child is, what is their refractive error, and their prescription at that point in time. There have been studies that have looked at lots of other factors that require additional instrumentation measures, such as length of the eye and various different ocular components of the eye, and adding those things into predictive models doesn't help us much more to determine who's at risk. So when we have kids who are not yet nearsighted, how close they are to becoming myopic and how old they are at that point in time is really the best predictor with high sensitivity and specificity of whether or not that child is at risk of becoming myopic later on. We also know that if a child has one or two myopic parents, that also increases the likelihood that they're going to be myopic. So those are really the things that we have, and they don't require special diagnostic equipment in order to be able to look at that.

Now, the caveat is kids who don't have a problem seeing at distance aren't the kids who are coming in for eye examinations, so catching myopia when it first onsets is really the biggest thing that helps us to then apply interventions to help slow its progression because we know that when we apply interventions when onset first happens—that's when myopia is progressing the fastest—we have the best ability to then try to slow its progression. But the issue is that kids don't typically notice that they become nearsighted. It's often caught by a vision screening or something else because the change for them is so gradual that they don't realize that they're having a hard time seeing the board. They just think this is the way everyone else sees, so that's kind of one of the biggest challenges. So the good news is we don't need special equipment in order to be able to figure out which kids these are.

Ryan Quigley:
Now, turning back to you, Dr. Twa, in the realm of optical interventions, what are the most promising developments in lens design for slowing myopia progression?

Dr. Twa:
Yeah, these are exciting times in terms of intervention possibilities. One of the main strategies is that devices which can produce uniform focus across the retina, not just in the center of vision but across the retina, are really the strategies that we're starting to see come out right now. That includes contact lenses that have zones that produce different focal powers across the lens to achieve this uniform focus. And we also have internationally—not approved in the U.S. yet, but internationally—some glasses that can be made with more complex optical properties beyond what old-school bifocals can do. These can create focal zones much like what the contact lens designs are doing, providing that uniform focus across the image of the full eye, but you can also alter the contrast of the images in ways that modulate the visual input to the eye without compromising vision.

This is really an active area of development and ongoing clinical trials; David, I should really turn this over to you. You've done a lot of the foundational work in this in the International Eye Institute studies.

Dr. Berntsen:
Yes, the last 10 years of my work along with my collaborators at Ohio State is on a National Eye Institute-funded study that looked at one of these types of special contact lenses to look to first see, can we slow the progression of nearsightedness, which we were able to show that, yes, you can; and then beyond that, what happens when you take these kids out of these interventions? Because a concern is if something slows progression, what happens when you take them out? Does the eye, I'll call it, "rebound" where it accelerates its eye growth and just goes back to where it would have been had you never done anything to begin with? That's been a concern because we've seen that with some of the pharmaceutical agents that are being used to slow myopia as well. Fortunately, in our National Eye Institute-funded work, we found that kids, when they're older teenagers, and the type of contact that we used did not have a loss of their treatment benefit when we took them out—again, when they're closer to age 16, 17—so that's promising for these optical interventions specifically.

Ryan Quigley:
And, Dr. Berntsen, how about pharmacological strategies? What should we know about the efficacy and safety of current and emerging agents?

Dr. Berntsen:
So within the last couple of years, there have been a number of longer-term, two- to three-year clinical trials that have come out from various different parts of the world, and most of them are concentrating on low-concentration atropine, so there's various different low concentrations of atropine that have been investigated. What we're finding is that the results, depending on the part of the world you're in and the group that's being treated, are differing. For example, in Asia, there tends to be better results from those studies than we're finding when they're done in the United States, so this speaks to the importance of studies being done and not just uniformly applied across the globe. It's important that in the U.S. we're doing similar studies because the results are not always coming out the same.

One of the interesting things that's been found with low-concentration atropine is that the dosage matters. So in the literature, you'll see studies that have looked at low concentrations like 0.01 percent all the way up to 0.05 percent. It seems like the 0.05 percent, even though we don't have a study specifically in the U.S. yet, 0.05 percent seems to be working better in other studies across the world. The lowest concentration, such as 0.01, has very mixed results here in the United States, so I think most people are pushing to that slightly higher low concentration, if you will.

That said, we know from the studies that safety-wise, they're well tolerated; that's a very good thing to know, but it is going to be important that we look at this kind of disparity between what we see in studies performed in Asia versus here in the U.S.

Ryan Quigley:
For those just tuning in, you're listening to *Eye on Ocular Health* on ReachMD. I'm Ryan Quigley, and I'm speaking with Drs. Michael

Twa and David Berntsen about evolving approaches in myopia management.

So, Dr. Twa, with the current state of myopia management in mind, I'd like to ask you about what's next for the field. How might AI-driven predictive modeling and telehealth platforms change the way we monitor and manage myopia over time?

Dr. Twa:
Yeah, that's a great question, Ryan. Predictive modeling has shown some promise in helping to identify myopia, but really, I think we're at the beginning of our understanding of trajectory. I do think that AI-driven predictive modeling has the promise to give us some very individualized answers about what to do in a specific case, and that's really where we want to be. This is the whole drive of the National Eye Institute and precision health and precision medicine, but it will take a lot of data to get there, and we have been for the past 20 years collecting the demographic data and understanding trajectory and growth curves.

Don Mutti at Ohio State has done some really nice work across a large group of investigators nationally to create some eye growth models. That's the kind of data that we need to be able to really leverage AI for this. So I think that's to come and the promise is there, but it's not ready to deliver quite yet.

As far as monitoring and telehealth applications, I think there's an interesting possibility. We really need to focus and double down on detection because early detection and appropriate early interventions is where we could be using telehealth platforms. The monitoring of progression with the right technology may also be really valuable, but again, I still think we're ahead of the curve in being able to have those tools and apply them. Those who are doing so at this point in time are really out there on the frontiers of what we should be doing, so kudos to them, but I think the evidence is going to come a little bit later. We're still working on that.

Ryan Quigley:
Now, Dr. Berntsen, gene therapy and regenerative approaches have been hinted at in early-stage research. How realistic is it that we will see these in clinical practice in the near future?

Dr. Berntsen:
In the near future, I don't think that's where we're going to be going straight to. The optical and pharmaceutical strategies are the things that we're going to see getting approval the soonest and are going to be the easiest to be able to implement. One of the issues with myopia is there's not just a magic myopia gene. When you look across chromosomes, in various different analyses, there are a number of genes on a number of different chromosomes that are associated with myopia. So there are some newer things that are emerging that are looking at some specific therapies, but these are all very early, so as far as something within the next in the next few years, I wouldn't see that as being the mainstay of what's going to be out there. I think what I'm hoping we will see is that there is large uptake in utilization of the other strategies that have all now hit the phase III clinical trials where we know that these optimal pharmaceutical and novel spectacle designs are all out there and available because just in general, there's no one magic treatment for slowing myopia and what works for one child is not going to be what's a best fit for another child. Not every child is going to be a candidate for contact lenses. That's where spectacles can come in great. Some may not want to or it may be a challenge to do spectacles, for example, for a kid who's active in sports, and that's where some of the contact lens therapies or some of the pharmaceutical therapies may be a better fit.

Ryan Quigley:
And finally, Dr. Twa, do you have any key takeaways you'd like to share on how our approach to managing myopia will continue to change in the next few years?

Dr. Twa:
It's about early detection and appropriate interventions, and we've discussed a number of those here today. And then I think it's also about continuing to invest in our own future. These are solutions that are going to pay big dividends in the long run. This is a massive problem that we're facing globally, not just in the U.S. but around the world, so the potential to bend the curve and reduce the cost and reduce the burden and improve the quality of life is really significant here. And I think in order to really understand the many different potential mechanisms driving myopia in the first place, we are going to have to have a data-driven strategy, and this involves things like AI. This involves collaboration across institutions and around the globe to help address these questions. They're not simple.

Ryan Quigley:
And with those key takeaways in mind, I want to thank my guests, Drs. Michael Twa and David Berntsen, for joining me to discuss current and future approaches to myopia management. Dr. Twa, it was great having you on the program today.

Dr. Twa:
My pleasure. Thank you, Ryan.

Ryan Quigley:
And, Dr. Berntsen, it was great having you join us as well.

Dr. Berntsen:
Yeah, it's my pleasure as well. It was great being here.

Ryan Quigley:
For ReachMD, I'm Ryan Quigley. To access this and other episodes in our series, visit *Eye on Ocular Health* on ReachMD.com, where you can Be Part of the Knowledge. Thanks for listening.