Myopia Control - Everything You Need to Know

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Intro to Myopia Control

There are no shortage of theories on the mechanisms of myopia development and progression. Genetics, near work, time indoors, artificial lighting, diet; all these factors have been investigated as potential causes of/correlates to myopia.

The fact of the matter is there isn't "one flavor" of myopia. Which is probably why we haven't figured out how to "control" it yet and also why when our patient's ask, "Is there a cure for myopia?" We don't have one simple answer.

While theories often make for good narratives, they don't directly help the eight year old in your chair that just progressed a diopter in 10 months. Fortunately, there are a number of strategies you can take advantage of to help slow her progression without knowing exact mechanism you're acting on. Similarly, you don't have to know how the physics of riding a bike work in order to ride it.

As a clinician, you want to be able to DO something for these kids. You want a solution. There isn't ONE, but there are a few choices.

So instead of discussing theories, let's discuss **facts**.

The Facts About Myopia Control

Though nearsightedness seems like a simple concept when explained optically, the question, "What is Myopia?" has to be addressed in a more

global sense before we can begin discussing treatments.

Myopia is an adaption of modernity. There is no argument that the prevalence of nearsightedness is much higher today than it was even 30 years ago.[1] The rapid increase in prevalence alone answers the nature vs. nurture question. Myopia genes didn't suddenly come out of hiding and start turning half the population into myopes. But don't myopic parents have myopic children? Not exactly. Myopic parents have children who are more susceptible to becoming myopic.

It's a predisposition, not a destiny.

That leaves the environment as the culprit. But, there remains a heck of a lot of potential factors. Is it the light? Is it the near work? Is it the exercise? Is it the diet? Is it retinal defocus? Yes, no, and maybe.

It doesn't really matter.

You're going to recommend the kid detach herself from the tablet, go outside, run around, play in the dirt, come inside for a dinner of minimally-processed, whole foods, and then go to bed on time regardless of refractive error. Because that's just what kids should be doing. In short, you're recommending kids be kids (not a bad idea for adults to do those things either.)

Unfortunately, we all know the reality of compliance to lifestyle modification recommendations. The threat of an increased prescription probably won't be enough to cause a radical change in a family's life. So the only option we are left with is to develop some protection from the environmental factors primed to turn your patient into a myope.

But, before we get into treatment strategies, let's talk about risks and benefits. It doesn't make sense to pursue a treatment if the benefits don't outweigh the risks.

Below is a table adapted from Flitcroft's review of myopia.[2]

As the degree of myopia increases, the odds ratio of a number of ocular diseases increases, sometimes dramatically.

To put that into context, the odds ratio of an increase in stroke risk given a systolic blood pressure of 159 mmHg – a pressure at which many family physicians would not hesitate to start treatment – is 2.2.[3] Certainly a stroke is more serious issue than a PSC but you get the point. You can justify treatment in order to reduce risk later of ocular pathology later in life.

Aside from disease, quality of life benefits are huge. A -2.00 myope is much more functional uncorrected than a -6.00. It's the difference between reading comfortably without correction (and having a leg up when presbyopia comes around) and being completely reliant on correction all waking hours. So let's get into what you can do.

Myopia Control Methods

Here are you choices for intervention.

Do nothing

If the goal is solely to "control" myopia, this probably isn't the worst option.

If you turned away your myopic patients at the door, most would land in the -2.50 to -3.00 D range with zero intervention (the reason is its own topic of discussion). Unfortunately, we as optometrists have this pesky reputation for helping improve the clarity of patient's vision. They've now come to expect it. While you're not risking causing harm to the child as a result of unknown treatment effects, no intervention is not a great practice builder. We'll put it on the "less than ideal list."

Single Vision Distance Rx

The “gold standard.”

Also, probably the worst “control” strategy. Progression of children with full time correction is greater than those who were not corrected at all.[4,5] Yet, single vision distance correction continues to be used as the “control” group in myopia control studies even though the modality is likely accelerating the myopia progression. What are the consequences? **ALL** results of the randomized control trials looking at control strategies are skewed. It’s difficult to say with certainty how much they are skewed; but, the control modalities are likely less effective than the results might indicate.

Contacts and glasses cause similar rates of progression (about -0.75 D per year). [6–8] So between the two, contacts might be worse due to an increase in microbial keratitis risk.

Either way, bumping up the minus to temporally optimize distance acuity is a lot like putting studded tires on your car all year long. They’ll work great the few times when you need them; but, the rest of the time you’ll burn more energy trying to get to where you need to be and they’ll also wear out within the year.

Multifocal spectacles

Better than single vision lenses.

Executive lenses appear to be better than PALS.[6,9] You get about a 33% reduction in myopia progression.[10] Some will argue that an executive provides larger area of peripheral myopic defocus and that’s why they work. That could be true. The fact is that an executive is much easier to use. You look above the line to look far away and below it to look close. There is no image jump because the optical center of both lenses is directly at the line.

The question then becomes, how much add power?

That is your clinical decision based on your beliefs of what myopia really is. One group studying executive lenses used an add power of +1.50.[9] Those arguing the peripheral blur theory mentioned earlier may say a higher add power (+2.00-+2.50) would provide more peripheral myopic defocus strictly based on the optics. This has not been studied. The group arguing the near point stress theory would say that add is much too high and the near add should be enough to provide some change in behavior (+0.50 at low end); but, should not exceed the fused crossed cylinder measurement, which is considered by some to be the maximum amount of plus/least minus that will be accepted at near.

As a result, most of the add powers I see going out the door by the practitioners doing this regularly are in the +0.75 to +1.25 range. That said, the choice is ultimately yours.

As for risks, a bifocal provides no more risk to the child than a single vision lens; but, you cannot guarantee they will look through the add portion when doing near work. The other risk is that parents will look at you funny when you suggest their 10 year old wear a Ben Franklin bifocal. Buy in is a real problem and the explanation as to why is crucial. In addition, the reality may be that you don't work with a lab that will do an executive or an insurance company won't cover that design. Flat top-35s with an altered add power may be a compromise you have to make. So if contact lenses are out of the question, this may be your best option aside from atropine (more on this later).

Ortho-K

With an average reduction in myopia progression of 45%, Orthokeratology is certainly an option for patients.[11]

The number of lens designs is growing and there are even some lenses being designed specifically for myopia control. That said, it is probably the

most nuanced and technically difficult modality to use. Some tips and tricks presented at conferences border on being considered black magic. Discussing all of the potential fitting strategies and lens designs is beyond the scope of this article. It is recommended you communicate with a practitioner who has been fitting ortho-k lenses for a while if you're just starting out.

Provided you nail the fit, the obvious advantage is that the lens theoretically provides continuous peripheral myopic defocus to the retina. And it is unique in that the optics are present at all times. The child cannot simply take off the lens and put on their single vision glasses at the end of the day like they could with soft multifocal contact lens.

However, an ortho-k lens is more invasive than a spectacle lens. You're physically changing the shape of the cornea. Ortho-K advocates will say that the change is strictly an epithelial phenomenon and the 7-day turnover rate of the tissue will completely reverse the effects of the treatment. There is convincing evidence this is the case and that long term ortho-k wear causes no permanent changes to corneal shape or physiology. [12]

Conversely, practitioners who are opponents of the modality have claimed to have seen long-term, permanent changes in corneal shape in past ortho-k wearers. The truth is likely somewhere in the middle. Poorly fit lenses or non-compliance could certainly result corneal damage. Other drawbacks of orthokeratology include microbial keratitis rates similar to that of other overnight wear modalities. So if you provide ortho-k services, spend some time developing fitting skills and making sure the patient understands the risks involved and how to reduce those risks. If the job is done well, the fitting fee – which is often significantly higher than that of a soft multifocal contact lens – can be justified.

Multifocal Soft lens

Multifocal soft lenses are similar to ortho-k (about 48%) in their ability to slow progression.[13] Specifically, center distance lenses. The optics presented to the eye are similar to those provided with ortho-k (myopic peripheral blur). Studies have investigated both concentric ring add designs and aspheric add designs with similar results.[8,14–16] All lenses had adds of between 2.00 and 2.50 D. None of the lens designs studied are commercially available. That said, you may have one lens in a fitting set of yours that is a center distance design. There are some doctors using this lens for myopia control.

Additionally, there are a number of custom soft companies making center distance multifocal designs. There is no reason you can't use these for controlling myopia. Things to consider when designing a lens include center optic diameter (usually 2.0 mm), add power, add design (aspheric, concentric ring, linear) and decentration of optics over the line of sight. The peripheral blur theory would suggest the smallest center optic diameter tolerable with the largest add power and area tolerable would provide the eye with most robust signal to stop growth. Yet, we are still in the midst of figuring out what designs work best in practice.

Another option that is less recognized as a potential modality is the center near multifocal soft lens. The argument against this lens design is that it effectively presents the eye the inverse optics of the center distance design. And, a lens that provides optics opposite of the center distance lens should create the opposite effect, right? Wrong, while it is true the center near lens does provide a different optic to the retina, it is still simultaneously providing both hyperopic and myopic blur. Even if the blur theory of myopia holds true, as long as there is enough myopic blur presented to the retina, growth will slow down. It doesn't matter if that area includes the fovea or not. This lens design also fits the requirements if the near point stress theory holds true.

The huge advantage of this lens design over the center distance lens is

its availability.

The number of off-the-rack lenses is quite high, making it a much easier, time efficient lens to fit. Unfortunately, no one has studied center near lenses for myopia control. I have talked to a number of private practice doctors using the lenses for myopia control and have seen data suggesting progression rates similar to that of a center distance lens. The caveat of this data is that many of the patients fit in these lenses were in their early to mid-teens which is often after the peak rate of progression for your standard myope and the natural slowing of progression in these years may have padded the stats. Regardless, center near multifocal lenses will NOT increase the rate of myopia progression. So what do have to lose by fitting a young myope in a center near multifocal if you were planning on fitting them in spherical soft single vision lens anyway?

Here is the protocol recommended to me by practitioners fitting center near soft lenses for myopia control:

- Perform a number 7 (most plus, least minus to 20/20- OU). Add -0.50 D to number 7. Equalize Rx between eyes if aniso is 0.25 D by cutting a 0.25 in more myopic eye. Pick a lens with a low to medium add (+1.00 to +1.50).
- Have patient return in 7-10 days after wearing lenses and perform number 7 again. The results should be approximately +0.50 – +0.75 greater than distance portion of the contact lens. All measurements are performed without cycloplegia.
- Have patient return in 6 months perform number 7 again. Do not be too quick to change Rx if patient has picked up +/-0.25 D. Use clinical judgment if change is more than +/-0.50.
- Up to a 1.00 D, possibly 1.25 D, of astigmatism can be masked with a spherical multifocal lens

The drawback with any multifocal soft lens is that not only do the children need to be responsible enough to handle and care for their lenses; they

need to have them on nearly all waking hours in order to maximize treatment effect. The patients must be motivated to use this modality, especially if they weren't even considering contact lenses when they sat down in your chair that day. But, if you can get them on board, this modality may be one of the simplest yet effective treatment options.

Atropine

In some studies, atropine has been shown to be the most effective way of controlling myopia. Rates average out to about 77%.[13] That said, the two studies cited most frequently, ATOM 1 and 2 used autorefractors to determine refractive progression.[17–19] And in the case of ATOM 2, the autorefractor and a-scan instrument used to measure the control group differed from that used to measure the treatment group. As such, we may want to look at the results with a healthy amount of skepticism. We also find there is a significant rebound effect when the treatment is stopped, especially with the traditional 1% atropine.

Read more about how to use atropine in myopia control here.

Low dose (0.01% or 0.02%) atropine has now become the most popular formulation as it has been shown to have less rebound effect than the 1% concentration. Additionally, the lower concentrations do not seem to measurably reduce the ability of a child to accommodate which is a major drawback of the higher concentrations.

The biggest advantage that atropine has over lens correction is its ease of administration. One drop in each eye once a day is all it takes. No taking lenses in and out every evening and morning. The biggest drawback of atropine therapy is that it is the most invasive method. There have been a number of case reports contributing mental toxicity and even death to topical ocular administered atropine.[20] Conversely, there are many practitioners using atropine promote its effectiveness and safety. While that

may be true, your adolescent patient is still on a long term medication that is considered an off label treatment. Use your best judgement.

Myopia Prevention

With all this talk of myopia control, who says you can't stop it before it starts? The group at Ohio State has been studying myopia for a million years and found the best predictor of myopia was current refractive error.[21] That means that our best guess at whether or not a child will become myopic is the amount of hyperopia she has at a particular age.

Here are the cut off points (cycloplegic spherical equivalents):

- Grade 1 (age 6) – less than +0.75 D
- Grade 2(age 7 and 8) – less than +0.50 D
- Grade 3(age 9 and 10) – less than +0.25 D

Using these cutoff points, you may be able to nip myopia in the bud by using strategies such as multifocal spectacles, multifocal soft lenses, or even atropine. The hard part is convincing a parent that their child is seeing just fine but you want to put them in glasses or contacts as a preventive measure. But, if you're able to frame it such that the family gets it, you might be able to save a few kids from a nearsighted future.

Conclusion

No matter what theories or treatment strategies you ascribe to, it won't change the fact that number of myopic or soon to be myopic children coming into your office will continue to increase. The question you must ask yourself is, "Do I keep doing what I'm doing?" If what you're doing happens to be single vision distance correction, it be a modality that could be contributing to progression. Or do you consider how some of the other treatment strategies fit into your practice philosophy.

Even if you don't stop it in its tracks, you may be able to slow the myopia down enough to keep someone functional at near and make presbyopia a much easier transition down the road. Ultimately, it's up to you on how to treat these kids and teens. Choose wisely.

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