

Myopia: The True Threat to your Vision

Dec. 28

Timetable (school-wide):

Dates	Milestones
✓ Dec. 29 - Dec. 31	Introduction, problem, hypothesis
✓ Dec. 31 - Jan. 6	Background research, causes of myopia
✓ Jan. 6 - Jan. 20	- Gather information (interviews, the internet) - Understand the concept of the different lenses patterns and their impact on myopia growth
Jan. 20 - Jan. 31	Work on and submit the science fair <u>online</u> presentation

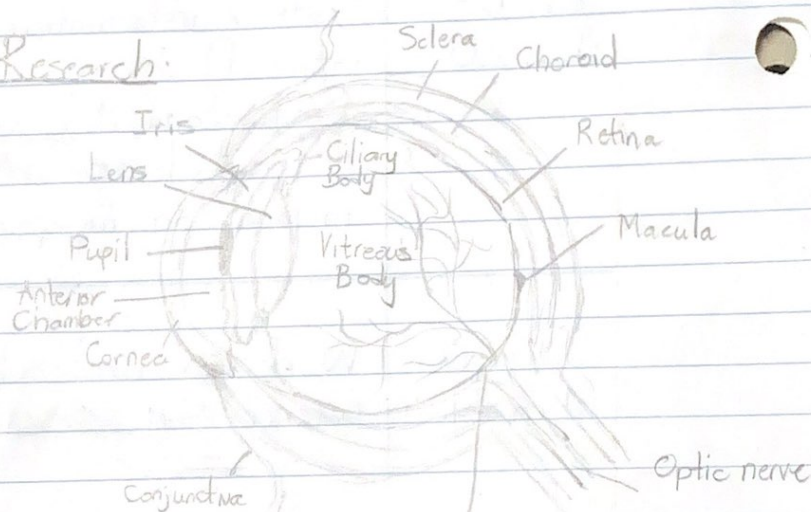
Dec 29 Problem:

What is myopia, and what are some of the solutions people are creating to reduce the impact of this condition? How do different designs used in the glasses lenses affect the growth of nearsightedness?

Hypothesis

If glasses lenses use special myopia control lenses, then it will reduce the progression of myopia, because the patterns will make your eyes focus on central vision instead of peripheral vision.

Jan 5 Background Research:



Cornea: Allows to focus by bending light

Pupil: Allows light to enter the eye

Lens: Helps focus light onto the retina

Iris: Controls the amount of light entering (by changing the size of the pupil)

↳ The coloured part in your eye (brown, blue, green etc.)

Retina: Tissue at the back of the eye that changes light into electrical signals

Optic Nerve: Nerve fibers/axons that take electrical signals from the retina → brain

Macula: Small part of the retina that helps with central vision

↳ Seeing from the front (straight vision)

Sclera: White outer coating of the eye that protects your eye from injuries + keeps its shape

Vitreous body / humor: Gel in the empty space of the eye that provides nutrients to the eye

Ciliary body: Changes the shape of the lens to focus

Anterior Chamber: Keeps the eye inflated

Optic Disc: Allows us to see by sending signals to the optic nerve from photoreceptors

↳ Photoreceptors convert light → electrical signals to make images in your mind

Conjunctiva: Protects your eye (covers part of your eye from the outside)

Choroid: Provides blood and nutrients to the retina

Jan. 9 What is myopia?

- An eye condition where objects that are closer to you are clear but objects farther away are less visible/blurry.

- When your eye starts growing in an oval shape



) you slowly get myopia.

↳ Light should reach on the retina when you see, but myopia causes light to reach in front of it

What causes myopia?

- Reading close-up
- Spending lots of time on a screen
- Genetics
- Other tasks done close-up and put stress on your eyes

Symptoms of myopia:

Jan. 15 - Blurry vision for objects in the distance

- Squinting to see "better"
- Headaches
- Eyestrain (eyes get "tired")
- Blinking more/constantly
- Rubbing eyes more than usual

Why does this happen?

- Your eyes are supposed to naturally grow / elongate, this stops at around the end of your teens (but for myopia it doesn't stop around there)

- Doing "near work" more often causes your eye to elongate
 - ↳ Doesn't bend light properly
- Doing near work strains your eyes more
 - ↳ Your eye blinks less close-up when focused at closer objects
- Your lens and muscles alter after being used to different, near work conditions
 - This causes your eye to elongate more

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Atropine Eye Drops

- Come in different doses, 1%, 0.5%, 0.01%, 0.05%
- Stops your eyes from focusing on nearer objects
 - ↳ Lets your eyes focus on things farther away, less strain on eyes

Pros

- Reliable
- Easier to examine your eyes during eye exams
 - ↳ Dilates/increases size of pupil

Cons:

- Only temporary
- Higher doses = more side effects
 - ↳ Lower dose = safer

Jan. 20 Laser eye surgery

- LASIK is most common type of laser eye surgery
- Changes shape of cornea for light to properly shine on the retina

↳ Cornea: Allows light to focus by bending light

- Surgeon cuts open the cornea (corneal flap)
- Uses laser to trim inner parts of the cornea

Pros

- Instant results (few days ^{or right} after surgery)
- Atropine eye drops need to be used overtime, but the surgery is a one-time thing

Cons

- Expensive
- Only available to specific age ranges
- ↳ Surgery is 18+
- ↳ Can't do surgery for older people because their eyes are more "rigid"
- Chance of side effects
- ↳ Dry eyes for long time
- ↳ Other diseases affecting your health

Jan. 23 Myopia control lenses

- Uses myopic defocus to slow down myopia
- Myopic defocus: Result of light in front of the retina, causes myopia
- Lenslets in the lens (look like small bumps) direct light in front of and on the retina at the same time

- ↳ In front of retina causes defocus
- ↳ Tells eye to slow down growing
- ↳ On retina is making eye grow properly
- Fixes more at the same time
- This is called the Volume of Myopic Defocus (V_oMD)

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Pros

- Best solution right now to slow myopia progression
- Lets you keep the same frame for longer, because of reduced chance of prescription increasing

Cons

- More expensive than other standard lenses
- Vulnerable to scratches + need good care
- Might not be available for all ages worldwide
- ↳ Still fairly new design
- ↳ Not lots of research conducted for the lenses yet

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Prevention

1. Spend time outdoors

- 1-2 hrs outside gives your eyes the right amount of light to stay healthy
- Outdoors require you to look farther
- ↳ Indoors have closer objects, puts more strain on the eyes

2. Limit screen time

- Not enough UV rays for your eyes to stay healthy in screens

- Spending time outside gives you more light rays than inside

3. Keep distance from closer objects

- Use devices in areas that have proper light
- Keep objects away from your eyes (farther away)
 - ↳ Puts less strain on your eyes
- Do less close-up work for long periods of time
 - ↳ Ex. sewing, reading a book

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My perspective

This topic connects with me because I also have myopia and have tried many of these solutions to slow down the progression of myopia. However, after trying the myopia control lens instead of a single-vision lens, my prescription has stayed the same, resulting in healthier vision. As myopia becomes more common, people must create new solutions to reduce the impact, which has already resulted in better results.

Conclusion

After researching the significance of myopia, I concluded that my hypothesis was supported. The myopia control lenses use lenslets to direct light in front and on the retina, which signals the eye to slow down growth. Among the many solutions people have designed, atropine eye drops, myopia control lenses, and LASIK eye surgery are the most effective. These designs

cause your eye to focus on farther objects instead of nearer objects, reducing myopia progression. From the data, myopia rates will continue to increase as it becomes more common, but these solutions may be able to reduce the impact of the disease. To further expand my knowledge about myopia, I would like to test different designs of myopia control lenses and see how different patterns change the occurrence of myopia.

Feb 27 Asking an Optometrist:

1. Why are certain lenses worse at reducing myopia progression than others?
2. How does myopia actually start in someone's eyes?
3. In your opinion, what is the best solution for myopia progression and why?
4. Why do screens affect the progression of myopia so much?
5. Are contact lenses better or worse than physical glasses frames and why?

- Where can I get an eye model?
- Any glasses lenses (as many types: mainly lenslet glasses) that I could borrow?

Ortho-K 24 hr treatment

- (Other lenses take off at night
- Complicated, but effective

2. Eye tells itself to get longer even though it's already long, keeps getting long
 - Stabilizes mid-20s
 - High prescription -6 (degenerative)
3. Ortho-K, not accessible, fitting for eyes?
4. Myopia control lenses
 - Its ok, use atropine easy to use

5. Eye surgery

- Don't do young
- ↳ Eyes change over time
- ↳ Cuts more from cornea depending on prescription
- ↳ Damages nerves + might cause disease + less protect
- High risk + high reward
- PRK doesn't cut nerves as much
- ↳ Hurts healing
- Smile is good, irreversible

- ## 6.
- Less blink
 - Muscles strain
 - Go outside
 - Long-term in future

7. Not fixing stigmatism (shape)

Contacts does fix then, like Ortho-K

- Use axial length measuring to indicate myopia
- ↳ Myopia eye length grows before prescription

↳ Contacts changes shape during

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