

Myopia (Near-Sightedness)

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THE STORY IN ONE SENTENCE

Close things look clear but far things look blurry because the eye focuses light in front of the retina instead of right on it.

“The eyeball is too long or the lens bends light too much, so distance vision lands short of the sensor.”

Normal anatomy — the body's job

The eye works like a camera: light enters through the clear front window (the cornea), passes through the lens, and lands on the retina at the back, which sends the picture to the brain.

BODY'S JOB

The cornea and lens together bend (refract) incoming light rays so they converge into a focused point exactly on the retina. The retina is a thin layer of nerve cells that turns light into electrical signals, which travel down the optic nerve to the brain. When the focal point lands precisely on the retina, you see a sharp image at any distance.

1. Light rays from a distant object (like a street sign) enter the eye as nearly parallel beams.
2. The cornea (the curved clear dome on the front of the eye) bends the light rays inward.
3. The lens (a flexible disc just behind the pupil) fine-tunes the focus by bending the light a bit more.
4. All the light rays converge to a single sharp point on the retina at the back of the eye.
5. The retina converts the focused light into nerve signals and sends them through the optic nerve to the brain.

What breaks

In myopia, the eyeball is too long from front to back, or the cornea and lens bend light too strongly—sometimes both. Either way, light from distant objects focuses into a point before it

reaches the retina, then spreads out again by the time it hits the back of the eye, creating a blurry image.

CLINICAL TERM

Refractive error—axial myopia (excessive axial length) or refractive myopia (excessive corneal or lenticular power)—resulting in a focal point anterior to the retinal plane.

How the body compensates

The eye itself cannot shorten or flatten enough to fix myopia on its own. Instead, we use external lenses (glasses or contacts) that spread incoming light rays slightly before they enter the eye, so the rays focus farther back and land exactly on the retina.

1. {'attempt': 'Squinting to see distant objects more clearly', 'result': 'Squinting narrows the eyelid opening, which blocks some of the scattered outer light rays and creates a pinhole effect, slightly sharpening the blurry image. This is a temporary trick and does not fix the underlying focus problem; it also causes eye strain and headaches if done constantly.'}
2. {'attempt': 'The lens inside the eye tries to adjust by relaxing (flattening) to reduce focusing power', 'result': 'The lens has only a small range of adjustment, and in myopia the mismatch is usually too large for the lens to overcome. Straining to relax the lens for distance can cause eye fatigue and discomfort, but vision remains blurry.'}
3. {'attempt': 'Wearing glasses or contact lenses with a concave (minus) prescription', 'result': 'A concave lens diverges (spreads out) light rays before they enter the eye, so by the time the eye's own lens and cornea bend them back together, the focal point is pushed back to land on the retina. This fully corrects distance vision and eliminates blur.'}
4. {'attempt': 'Refractive surgery (LASIK, PRK, SMILE) to flatten the cornea', 'result': 'The surgeon reshapes the front surface of the cornea with a laser, reducing its curvature and thus its bending power. This permanently shifts the focal point back onto the retina, so the person can see clearly without glasses or contacts (though myopia may slowly progress again over time, especially in younger patients).'}}
5. {'attempt': 'Orthokeratology (ortho-k) rigid contact lenses worn overnight', 'result': 'Special hard lenses gently reshape the cornea while you sleep; you remove them in the morning and enjoy clear vision all day. The effect is temporary and reverses if you stop wearing the lenses, but it can slow myopia progression in children.'}
6. {'attempt': 'Low-dose atropine eye drops (in children)', 'result': 'Dilute atropine (0.01–0.05%) given once daily at bedtime has been shown in clinical trials to slow the worsening of myopia in school-age children by about 50%, though the exact mechanism is not fully understood. It does not reverse existing myopia but helps prevent it from getting much worse during the growing years.'}

Domino effect

1. Eyeball grows too long or cornea/lens bends light too strongly during childhood and adolescence. — Genetics play a major role—myopia runs in families. Prolonged near work (reading, screens) and lack of outdoor time during childhood are also strong environmental risk factors that encourage the eyeball to elongate.
2. Light from distant objects focuses in front of the retina, so distance vision is blurry. — The eye's total optical power is too strong for its length, so parallel rays from far away converge too early and then spread out again before hitting the retina.
3. The person squints, sits closer to the board at school, or moves closer to the TV to see clearly. — Squinting creates a pinhole effect that reduces blur slightly; moving closer turns a distant blurry object into a near clear one, because near objects naturally focus farther back in a myopic eye.
4. Without correction, the person experiences eye strain, headaches, and difficulty with schoolwork, sports, or driving. — Constantly squinting tires the muscles around the eye and forehead. Blurry vision makes it hard to read the board, recognize faces at a distance, or see road signs, affecting safety and learning.
5. Myopia often progresses (worsens) each year during childhood and the teen years, requiring stronger glasses over time. — The eyeball continues to grow longer as the child grows, especially during rapid growth spurts. High myopia (worse than -6.00 diopters) can develop if progression is not slowed.
6. In high myopia, the retina stretches thin as the eyeball elongates, raising the risk of serious complications in adulthood. — A longer, stretched eyeball puts mechanical stress on the retina and the blood vessels that feed it. This increases the lifetime risk of retinal tears, retinal detachment (the retina peels away from the back wall), glaucoma (damage to the optic nerve from pressure or poor blood flow), cataracts (clouding of the lens), and myopic macular degeneration (breakdown of the central retina), all of which can cause permanent vision loss.
7. Regular eye exams and early intervention (glasses, contacts, atropine drops, or ortho-k lenses) help slow progression and preserve long-term eye health. — Correcting the blur improves quality of life and school performance right away. Myopia-control treatments in children can reduce the final degree of myopia, lowering the risk of sight-threatening complications later in life.

Symptoms · what the patient feels, and why

- **Blurry vision when looking at faraway objects (like a whiteboard or street sign):** The eyeball is too long from front to back, or the cornea (the clear window at the front of the eye) is curved too steeply. Because of this, light rays from distant objects focus in front of the retina (the light-sensing screen at the back of the eye) instead of landing right on it, so the brain gets a blurry picture.
- **Squinting to see distant things more clearly:** Squinting makes the eyelids squeeze together like a tiny slit, which blocks some of the scattered light rays and lets only the straighter ones through — this sharpens the image just a bit, like how pinching a hose makes the stream tighter.
- **Sitting closer to the TV or moving closer to see signs or faces:** When an object is closer, the light rays coming from it spread out less by the time they reach the eye, so they still focus clearly on the retina even though distant objects are blurry. Moving closer is the brain's way of bringing things into the zone that the eye can see sharply.
- **Headaches, especially after trying to see faraway things for a long time (like in class or while driving):** The muscles inside and around the eye keep trying extra hard to adjust the lens or hold the eye steady to make the blurry image clearer. This constant squeezing and straining tires out the muscles, which causes a dull, achy headache — like how your legs ache after standing too long.
- **Eye strain or tired, achy eyes by the end of the day:** The eye muscles work overtime all day trying to compensate for the blurry focus, and the brain works harder to make sense of fuzzy images. Over hours, this extra effort builds up fatigue in the muscles and nerves, just like how your hand cramps after gripping a pencil too tightly for too long.
- **Holding books or phones very close to the face to read comfortably:** Near objects naturally focus well in a myopic eye because the light rays are already more spread out when they enter, so they land right on the retina. Holding things close takes advantage of the eye's natural strength for near work and avoids the blur that happens at a distance.
- **Trouble seeing the board at school or recognizing people across the room:** Anything more than a few feet away sends light rays that are nearly parallel by the time they reach the eye, and the too-long eyeball or steep cornea bends those rays so they meet in front of the retina, leaving the actual retina with only a blurry, unfocused image to send to the brain.
- **Sudden, severe vision loss or a curtain/shadow blocking part of the visual field:** In high myopia (very strong near-sightedness, usually worse than -6.00), the eyeball is stretched so long that the retina becomes thinner and more fragile — like a balloon blown up too much. This makes it easier for the retina to tear or peel away (retinal detachment), cutting off the blood and oxygen supply to that part of the retina and causing sudden, painless vision loss.

- New floaters (tiny specks or cobwebs drifting in vision) or flashes of light, especially in someone with moderate to high myopia: The stretched retina can develop small tears, and the gel inside the eye (vitreous) may pull on the retina as it shifts or shrinks with age. The tugging stimulates the retina's light sensors, which the brain misreads as flashes. Floaters can be harmless clumps of gel, but a sudden shower of new floaters may signal bleeding or a retinal tear — an urgent warning sign.

Focused exam

- Visual acuity test at distance (20 feet or 6 meters) shows blurry vision that improves when the student moves closer or squints: This confirms the main problem: light from far away focuses in front of the retina (the light-sensing layer at the back of the eye) instead of landing right on it, making distant objects blurry. Near objects are clear because the eye doesn't need to work as hard to focus them.
- Pinhole test: vision improves when the student looks through a tiny hole in a card: The pinhole blocks scattered light rays and only lets straight ones through, which improves focus. This tells us the blur is a refractive error (a focusing problem in the eye's shape or lens) and not damage to the retina or optic nerve.
- Retinoscopy or autorefractometry measures how light bounces back from the retina, showing a negative (minus) diopter value: A minus number (like -2.00 or -5.50 diopters) confirms myopia and tells us exactly how strong the corrective lens needs to be. The higher the minus number, the more near-sighted the person is—meaning they can only see clearly at very short distances without help.
- Slit-lamp exam of the front of the eye and dilated fundus exam of the retina: High myopia (usually worse than -6.00 diopters) stretches the eyeball longer than normal, which can pull and thin the retina over time. This exam checks for early warning signs like retinal tears, lattice degeneration (weak patches), or myopic maculopathy (damage to the central seeing area).
- Axial length measurement with A-scan ultrasound or optical biometry: Myopia happens when the eyeball grows too long from front to back (normal is about 23–24 mm in adults). Measuring this length helps track whether a child's myopia is worsening quickly and helps decide if myopia control treatments (like special contact lenses or eye drops) are needed.

Diagnostics · every test answers a question

- Manifest refraction (having the patient read letters through different lenses to find the clearest one) → What is the exact lens power needed to bring distant images into sharp focus on the retina?

- Cycloplegic refraction (using eye drops that temporarily relax the focusing muscle inside the eye, then measuring the prescription) → Is the prescription accurate, or is the eye's internal muscle over-focusing and making the myopia look worse than it really is?
- Optical coherence tomography (OCT) of the macula and optic nerve → Is there any thinning, stretching, or damage to the retina or optic nerve from high myopia?
- Dilated fundus exam looking for peripheral retinal tears, lattice degeneration, or posterior staphyloma → Are there weak spots or holes in the retina that could lead to a retinal detachment?
- Corneal topography or keratometry (mapping the curve of the front surface of the eye) → Is the cornea too steep or irregularly shaped, and is the patient a candidate for contact lenses or refractive surgery later?

Treatment logic

- Single-vision eyeglasses with minus (concave) lenses, worn full-time or at least for distance tasks like driving, school board work, and watching screens across the room → The minus lens spreads incoming light rays before they enter the eye, so the image moves backward and lands on the retina instead of in front of it. This makes distant objects clear. The prescription is written as a negative number, like -1.50 or -4.00 diopters, matching the eye's refractive error.
- Soft contact lenses (daily disposable or two-week replacement) for active teens and adults who prefer not to wear glasses → Contact lenses sit directly on the cornea and provide the same optical correction as glasses but offer a wider field of clear vision (no frames blocking peripheral sight) and more freedom for sports and activities.
- Myopia control: low-dose atropine eye drops (0.01% to 0.05% nightly), orthokeratology (overnight rigid gas-permeable lenses that gently reshape the cornea), or multifocal soft contact lenses designed to slow eye growth → These treatments aim to slow the rate at which a child's eyeball lengthens during growth years (usually ages 6–16). Studies show low-dose atropine and ortho-k can reduce myopia progression by 30–60% over two to three years, meaning less severe near-sightedness and lower risk of high-myopia complications later in life.
- Increase outdoor time to at least 90–120 minutes per day of natural daylight exposure during childhood → Large population studies show that children who spend more time outdoors (not necessarily exercising, just being outside in daylight) have a lower risk of developing myopia or slower progression if they already have it. The exact reason is not fully understood, but bright outdoor light may signal the eye to grow more normally, and distance viewing relaxes the focusing system.

- Laser refractive surgery (LASIK, PRK, or SMILE) to reshape the cornea, typically offered to adults over age 21 whose prescription has been stable for at least one year → The laser removes a thin layer of corneal tissue to flatten the front of the eye, reducing its focusing power so that light lands on the retina without needing glasses or contacts. Most adults achieve 20/20 or 20/25 vision afterward and no longer need corrective lenses for daily activities.
- Preventive (Prophylactic) laser retinopexy (laser spots around weak or torn areas of the retina) in high myopia if lattice degeneration or small retinal tears are found on dilated exam → The laser creates tiny burns that scar and seal the retina to the underlying layer, reducing the risk that a tear will enlarge or allow fluid to seep underneath and cause a retinal detachment. This is a quick in-office procedure done under local anesthetic drops.

Medications

Atropine 0.01% eye drops · Muscarinic antagonist (anticholinergic)

Atropine blocks certain receptors in the eye muscle that normally make the eye's lens change shape for close-up vision. By blocking these receptors, it slows down the eye from growing too long (which is what causes near-sightedness to worsen in children).

1. The eye drops land on the surface of the eye and soak through to the inside.
2. Atropine attaches to muscarinic receptors on the ciliary muscle and blocks the signal that tells the muscle to squeeze tight for near work.
3. With less squeezing for near focusing, the eye receives signals that slow down the stretching and lengthening of the eyeball.
4. Over months to years, this slowing effect reduces how much worse the near-sightedness becomes in growing children.

SAFETY WATCH

Mild light sensitivity and glare (pupils stay slightly larger, letting in more light). · Slight trouble reading small print up close (because the muscle that helps focus for near work is partly relaxed). · Very rare allergic reaction (redness, itching, or swelling of the eye or eyelid). · This medication is used in children and teens whose myopia is worsening; it is not typically used in adults.

Red flags

- Sudden loss of vision or a dark curtain or shadow spreading across the visual field (may be retinal detachment — needs emergency eye exam within hours)

- Sudden shower of new floaters, flashes of light, or both together, especially in someone with moderate or high myopia (can signal retinal tear or detachment)
- Severe eye pain with blurry vision, nausea, and seeing halos around lights (may be acute angle-closure glaucoma, which is more common in certain eye shapes — needs emergency care)

Nursing priorities

1. Screen immediately for retinal detachment and acute glaucoma symptoms — Flashes of light, new floaters, a dark curtain over vision, severe eye pain, or halos around lights are emergencies. The retina (the seeing layer at the back of the eye) can tear or peel away in people with myopia because their longer eyeballs stretch it thin. Without fast treatment (often surgery within hours), permanent blindness can happen. High eye pressure from glaucoma can also kill the seeing nerve quickly.
2. Teach the patient how corrective lenses work and why wearing them matters — In myopia, the eyeball is too long from front to back, so light focuses in front of the retina instead of right on it, making distant things look blurry. Glasses or contact lenses bend the light just enough to move the focus back onto the retina so the picture is sharp. Wearing the right prescription helps prevent eye strain, headaches, and accidents (like while driving). Explain this so the patient understands it's not just cosmetic—it's functional and safe.
3. Encourage outdoor time and screen breaks, especially for children and teens — Studies show that spending at least 1-2 hours a day outdoors in natural daylight can slow down myopia from getting worse in young people whose eyes are still growing. Also, taking breaks every 20 minutes when doing close work (the 20-20-20 rule: every 20 minutes, look at something 20 feet away for 20 seconds) gives the focusing muscle inside the eye a rest and may reduce strain.
4. Schedule regular comprehensive eye exams (yearly for children with myopia, every 1-2 years for adults) — Myopia can get worse over time, especially during childhood and teen years when the eyes are growing. Regular exams let the eye doctor update the prescription so vision stays clear and check the health of the retina and optic nerve. High myopia (very strong near-sightedness) increases the lifetime risk of retinal tears, glaucoma, and cataracts, so catching problems early is key.
5. Educate about myopia control options for children with progressive myopia — Special treatments like low-dose atropine eye drops, multifocal contact lenses, or orthokeratology (special contacts worn overnight to gently reshape the cornea) have been shown in research to slow down how fast myopia gets worse in kids. Slowing progression now means less risk of serious eye disease later in life. Refer families to an eye doctor who offers these options if myopia is worsening quickly.

Sources

- American Academy of Ophthalmology (AAO) Preferred Practice Pattern for Refractive Errors
- American Optometric Association (AOA) Evidence-Based Clinical Practice Guideline on Myopia
- Cochrane Eyes and Vision systematic reviews on myopia progression
- World Health Organization (WHO) World Report on Vision 2019

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