OHCOW
Occupational Health Clinics for Ontario Workers Inc.
Centres de santé des travailleurs (ses) de l'Ontario Inc.

# Vision and Office Ergonomics

## How are they related and how do they impact one another?


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# Presentation Overview

- Introductions
- Visual Ergonomics
- Computer and Office Components Relating to Vision
- The Eye
- Eye Strain / Computer Vision Syndrome
- Common Visual Conditions
- Visual Correction for Presbyopia
- Corrective Lenses and Ergonomic Changes
- Questions

# **Ergonomics:** Working Smarter NOT Harder

Fitting the job to the worker

- Not all workers are the same size or have the same strength capabilities
- Aim is to design workstations, work processes, equipment, and tools to the worker

# **Visual Ergonomics:** Definition

"Visual ergonomics is the multidisciplinary science concerned with understanding human visual processes and the interactions between humans and other elements of a system. Visual ergonomics applies theories, knowledge and methods to the design and assessment systems, optimizing human well-being and overall system performance. Relevant topics include, among others: the visual environment, such as lighting; visually demanding work and other tasks; visual function and performance; visual comfort and safety; optical corrections and other assistive tools" (Visual Ergonomics Technical Committee, 2013)

# **Visual Ergonomics:** Relates to Everything!

Nature has made our visual system so dominant that we will alter body posture to accommodate any deficiency in the way we see.

- Reading – books, signs, etc.
- Commuting – walk, on-road vehicle, off-road vehicle, aircraft, watercraft, train, etc.
- Leisure and Entertainment – physical activity,  in home, large venue, etc.
- Manual work tasks – moving, carrying, sorting, etc.
- ELECTRONICS – home, work, school

VISION & OFFICE ERGONOMICS

# Why Vision and Office Ergonomics?

- We live in an electronic age
- Visual Habits are changing  - technology, COVID 19, work practices
- Lifestyles are changing – less activity, min. 7 hours per day screen time (computer, phone, tv, etc.)

# Main Ergonomic Risk Factors in the Office

**REPETITION**

Tasks or body movements carried out over and over such as constant mousing without adequate rest.

**AWKWARD POSTURES**

Body positions which deviate from neutral such as twisting your neck to view your monitor or reaching to use your mouse.

**STATIC POSTURES**

Maintaining a position for a prolonged period of time (e.g. prolonged sitting, viewing a computer monitor with a flexed neck, or reaching for a keyboard).

## Additional Risk Factors:

**FORCE**

- Exertion required to create, resist, or maintain movement

**CONTACT STRESS**

- External pressure that is applied to a part of the body for a sustained period

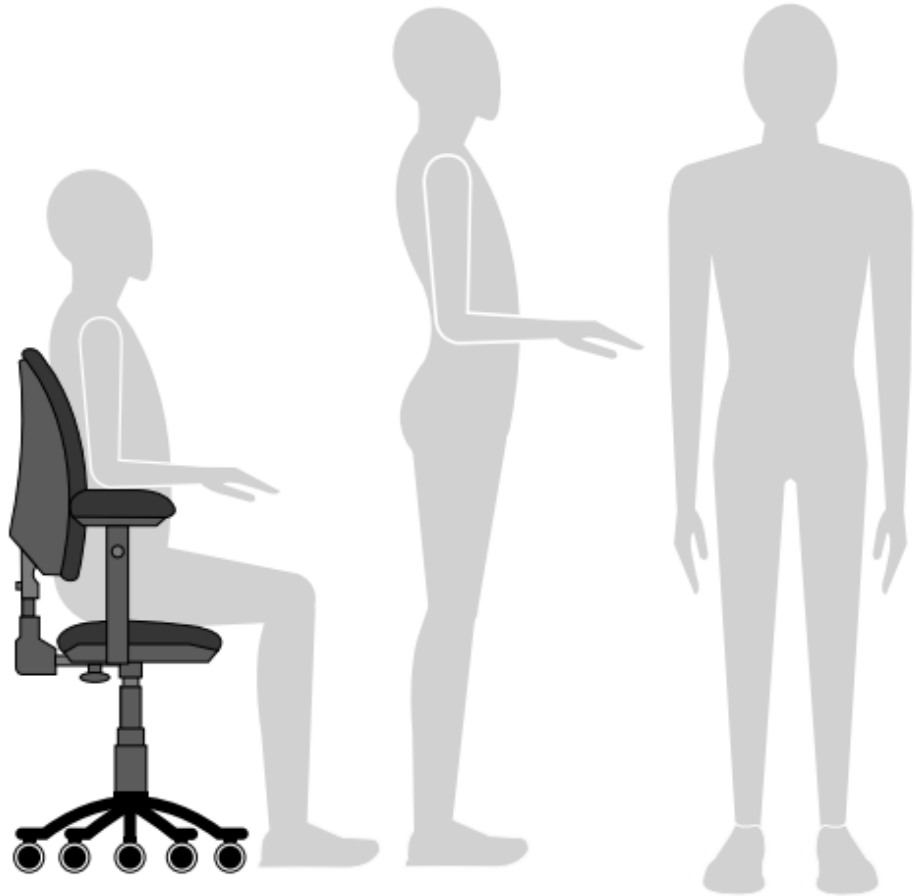
**PSYCHOSOCIAL**

- The combination and effect of nonphysical aspects (social, cultural, and environmental influences) on the mind and behavior

# Awkward Posture

Neutral Posture:
- Safest and most efficient position, minimizes stress on the body

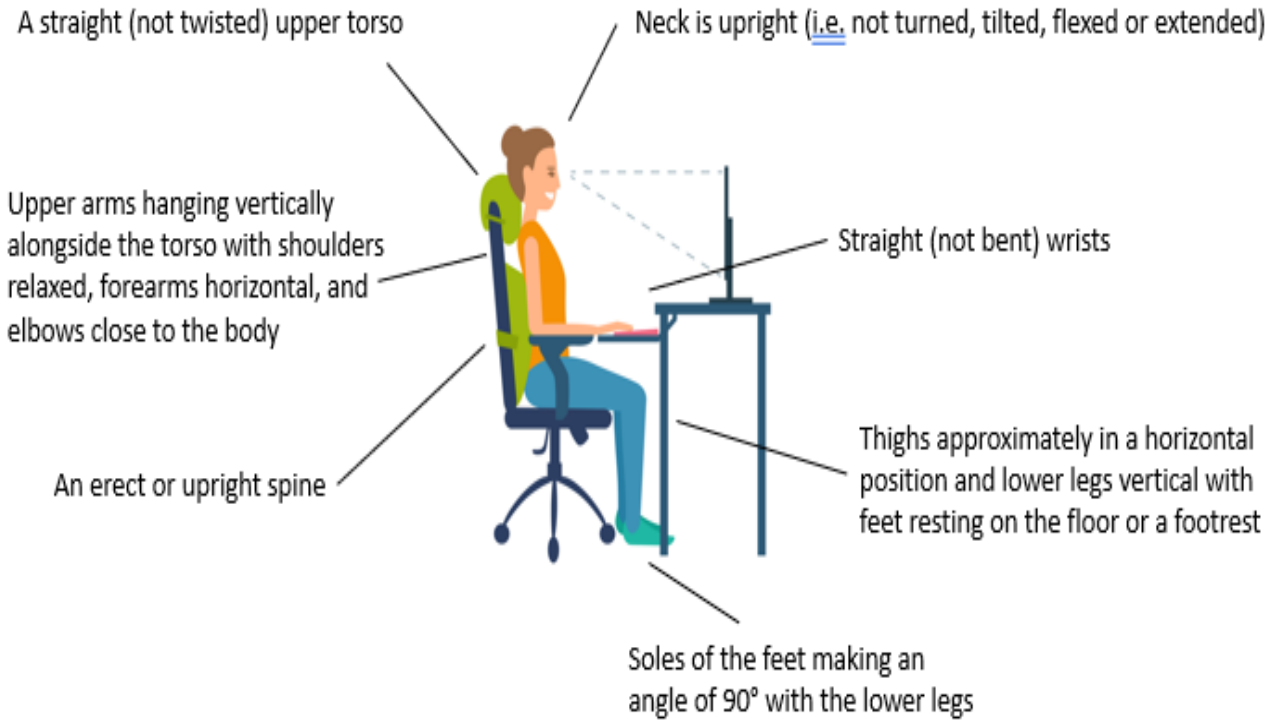
Awkward Posture may:
- Cause pinching or impingement on tissues
- Lead to asymmetrical loading
- Be a result of workstation configuration and equipment



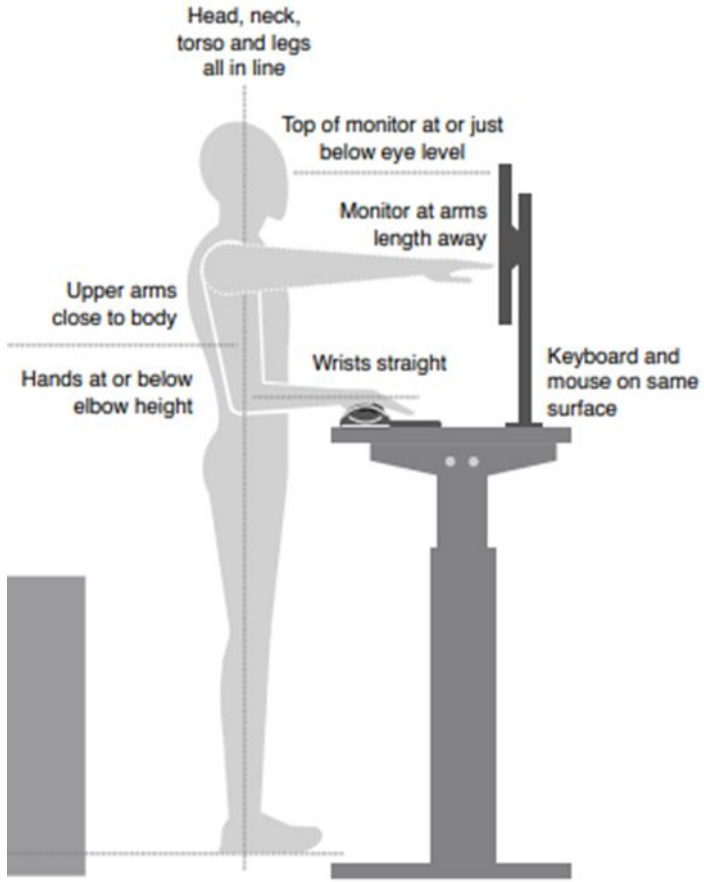
Neutral Body Postions

# Correct Working Postures

## Correct Sitting Posture




## Correct Standing Posture

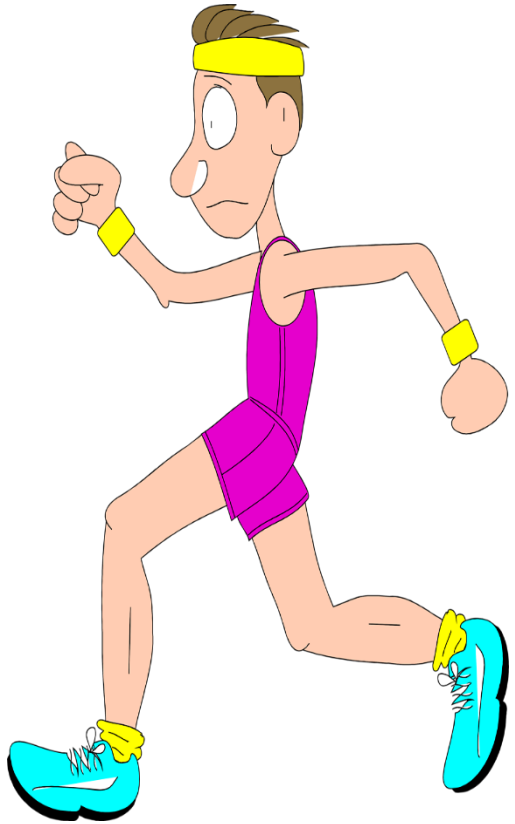


# Good Vision = Good Posture

- If Vision is compromised one will adopt posture to ease the strain on the visual system.
- Need good visual environment to have good work posture
- Poor vision = compensation  > may lead to MSDs
  - Neck, trapezius, upper back, shoulders, arms, low back

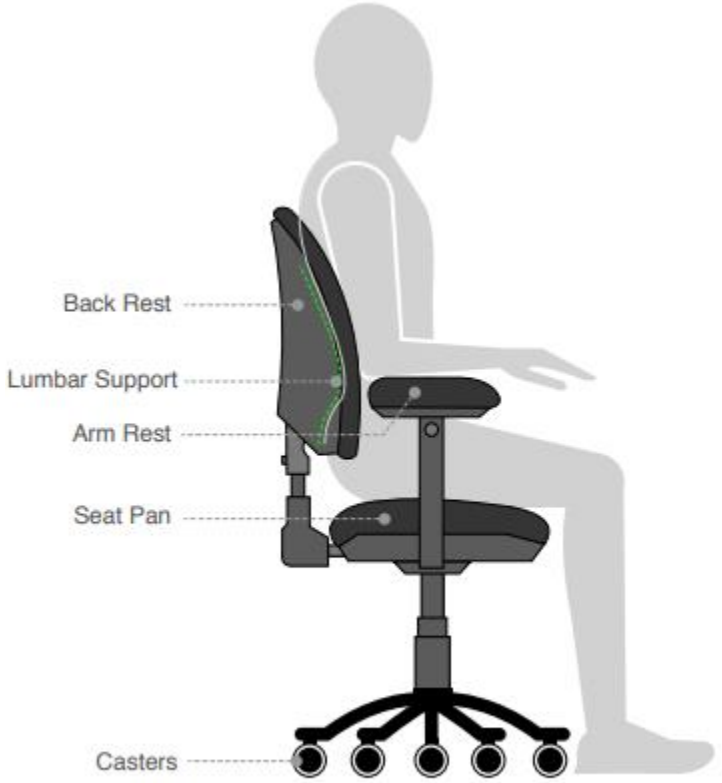
(photo courtesy of ERGOWORKS Consulting, LLC)

# Position and Eye Break: 20-20-20-20 (blink)



# Chair

- A chair is only “ergonomic” if the user can adjust it to fit their own personal dimensions
- The following parts of a chair need to be adjustable:
  - Seat pan- height & depth
  - Backrest- height & angle
  - Lumbar Support- height & depth
  - Armrests- height, width, and ability to rotate



Seated Neutral Posture in an Adjustable Chair

# Computer Screens/Monitors

View information correctly and easily

Size should be based on:

- Tasks performed
- Average viewing time
- Distance from which the user will be viewing it (small vs large screen)

Separate controls for brightness and contrast

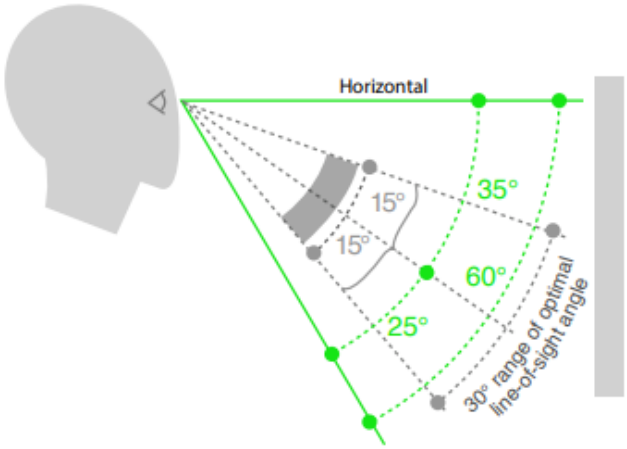
Height adjustable with swivel and tilt

Number of monitors based on tasks performed

# Computer Screens/Monitors: Angle & Placement

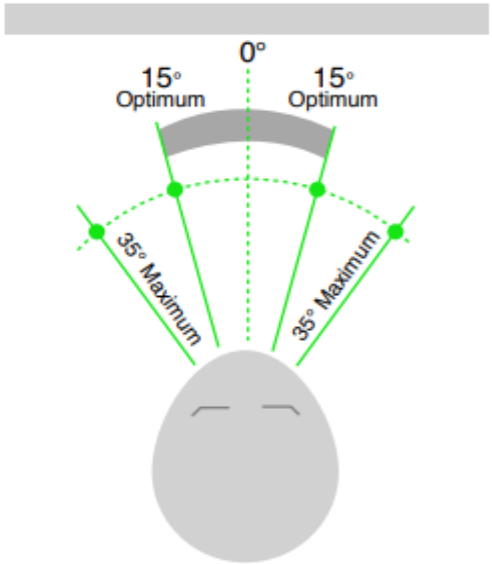
## Viewing Angle

The entire area of the visual display, including the keyboard and mouse should be located between horizontal eye level (0°) and below eye level (60°) when in neutral posture.




## Horizontal Placement

A single monitor should be centred directly in front of the user so that there is limited twisting of the neck and/or torso.

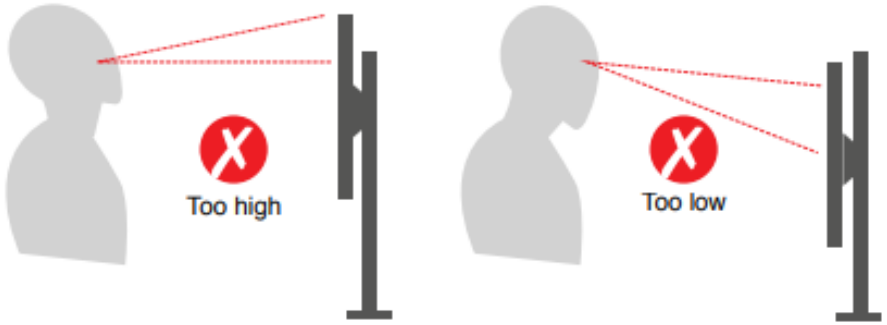


# Computer Screens/Monitors: Height

## Screen Height

The top of the viewing area of the monitor should be positioned at the user's horizontal eye height while maintaining a neutral neck posture.

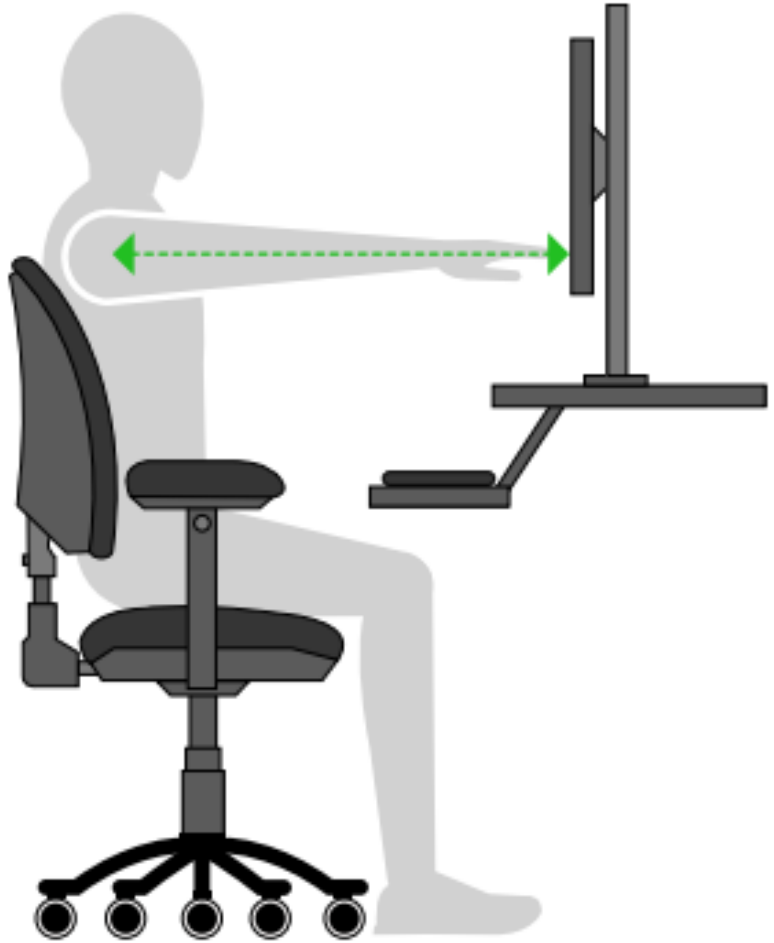

Note: Location and size of viewing area can vary depending on monitor design.




# Computer Screens/Monitors: Distance

## Viewing Distance

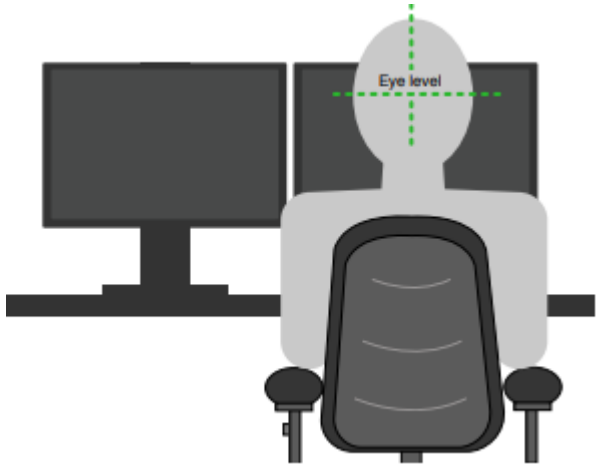
The monitor should be at approximately one arm's length away from the user so that the user may view the full contents of the monitor without excess eye strain while maintaining a neutral neck posture.

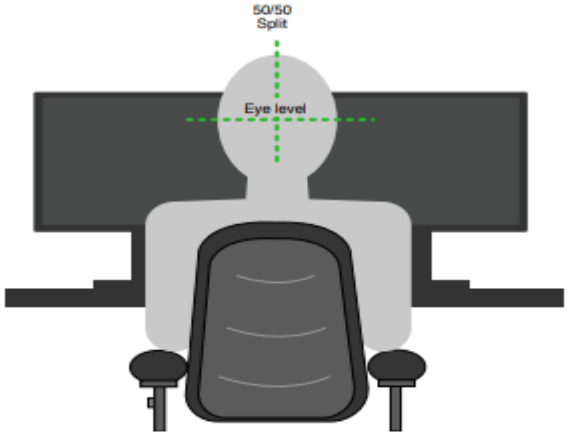


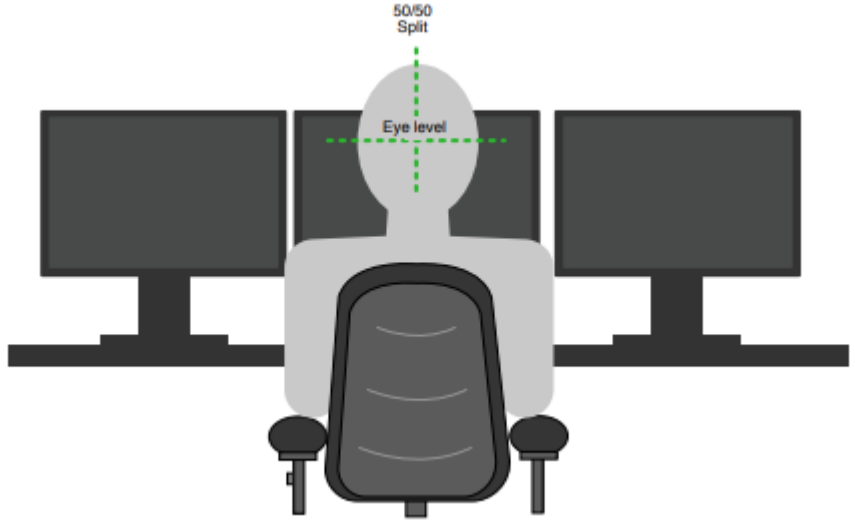
# Multiple Monitors

Need to consider:

- Positioned at the same height and close together
- If one used more frequently it should be centred directly in front of the user
- If two monitors used equally the meeting point of the two centred in front of the user
- If three monitors are present, they should be adjacent to one another with the middle monitor centred in front of the user

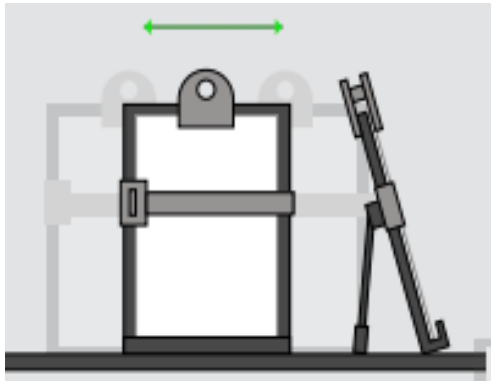


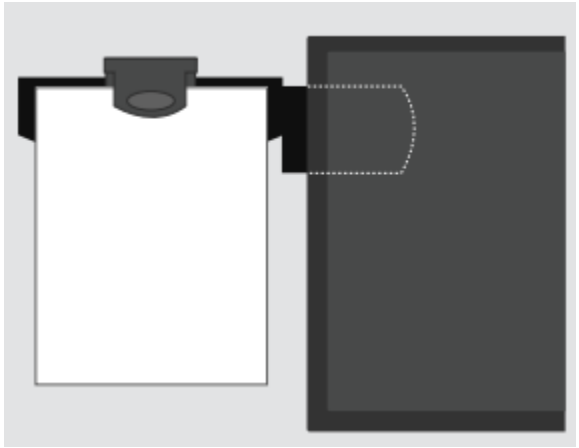



# Document Support

- Tasks that require users to read or refer to documents consistently require a document support to maintain neutral neck posture.
- Document supports should:
  - Accommodate the size and weight of the document
  - Placed between the keyboard and monitor, or adjacent to the monitor at the same height
  - Be adjustable in angle





# Keyboard

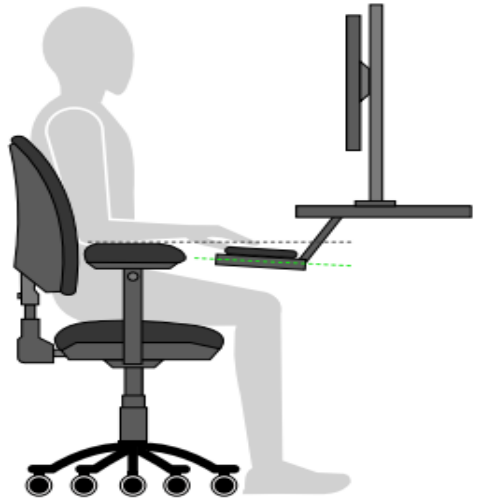
## Keyboard Placement:

- Slightly below elbow height and close to the body
- On the worksurface flat or a negative tilt
- Should be able to move the keyboard
- Hands should “float” above the keyboard
- Rest only the heel/pad of your hand

Keyboard positioned slightly below elbow height and close to the body

## Before selecting a keyboard consider the following:

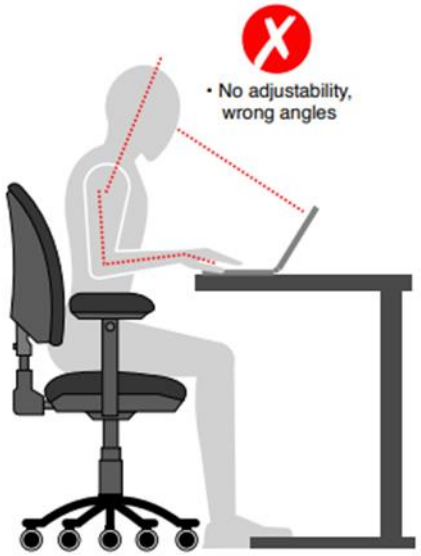
- Right or left hand dominant
- Numeric key pad usage
- Keyboarding proficiency
- Physical characteristics

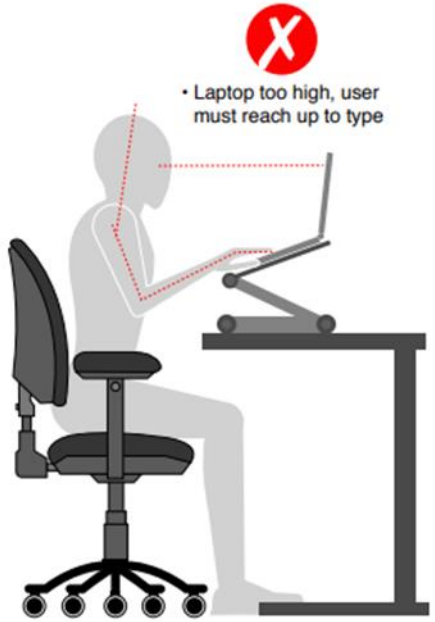


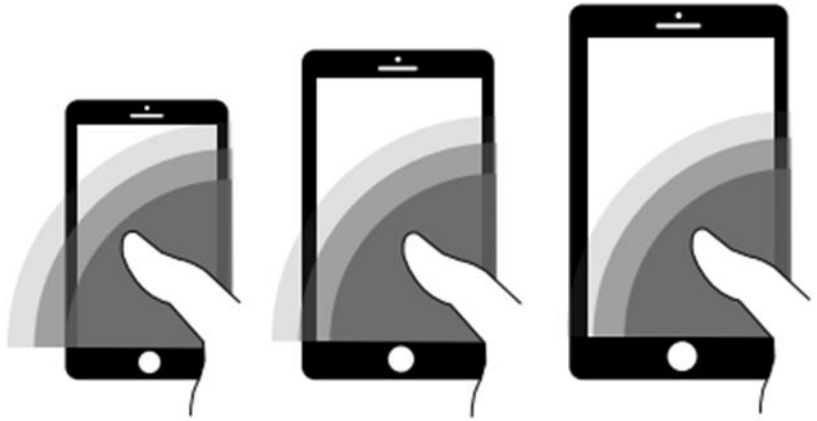
Keyboard placed on work surface (flat or slight negative tilt)

# Technology

Mobile devices such as laptops, mobile telephones, and tablets were not intended to be used for long durations. If they are, external equipment is recommended.



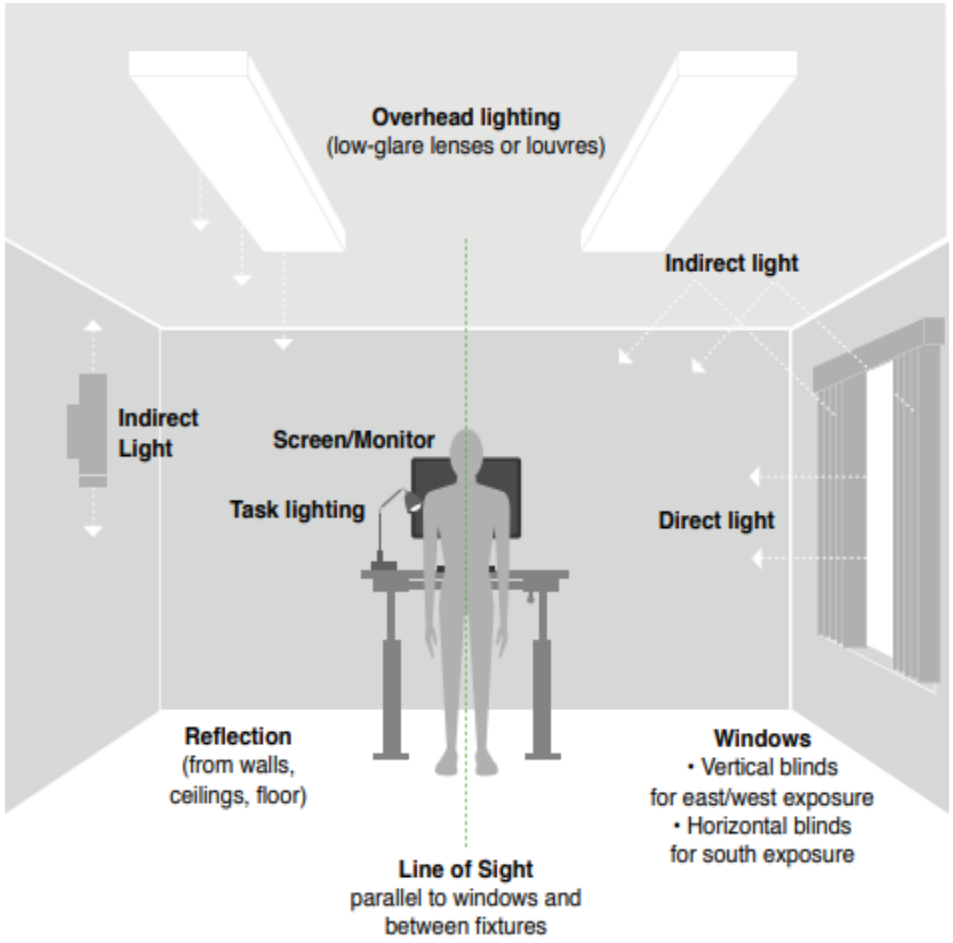
# Lighting

- Proper lighting is essential for visual comfort and to avoid eye issues and awkward postures
- Individual vision needs of user
- Consider:
  - Presence of natural light - best
  - Available artificial lighting
  - Colours, finishes, patterns on the ceiling,  walls, and other surfaces
    - “Soft” colours, not white or black
    - Matte vs gloss finish
    - Cluttered patterns vs limited or no pattern
  - Window coverings/treatments
    - Type, location
  - Direction of light (i.e. glare)

# Lighting: Glare

Reduce Glare by:

- Position workstation perpendicular to windows and between overhead lights
- Use curtains and blinds to control natural light
- Dim overhead lights
- Place filters on overhead lights
- Tint windows
- Anti-glare bulbs
- Cover monitor with anti-glare screen



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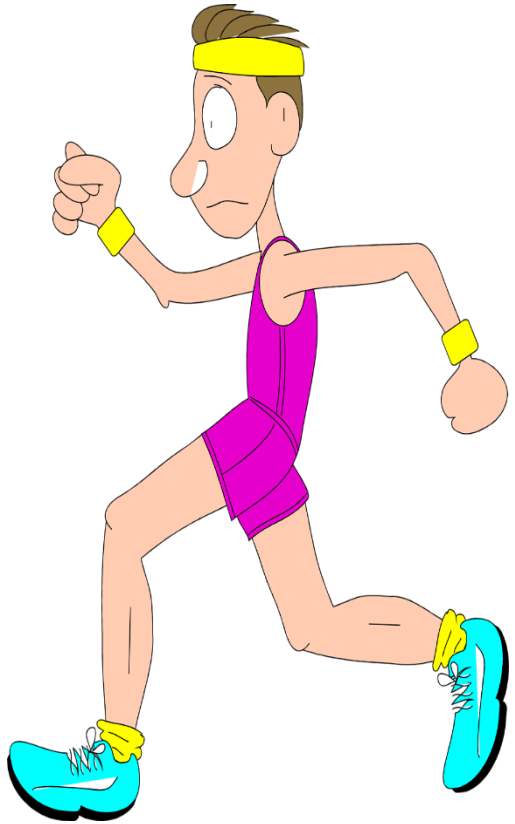
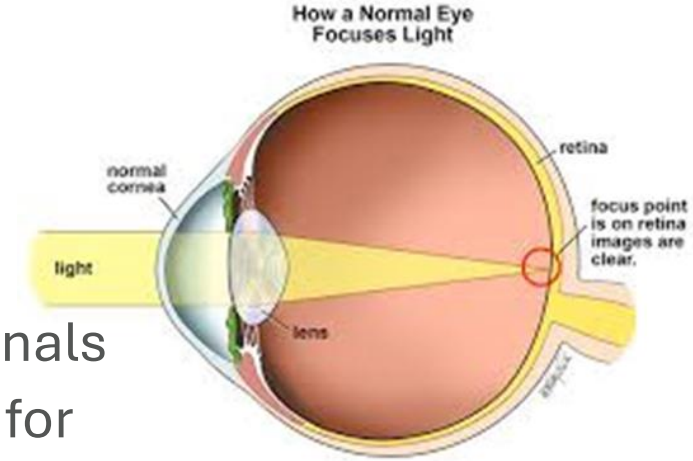


# The Eye

- The inner structures of the eye all work together to produce an image that the brain can understand.
- To produce a clear image, the eyes must complete a five step process:
  - Light enters the eye through the cornea
  - The pupil adjusts in response to the light
  - The lens focuses the light onto the retina
  - The retinal photoreceptors change the light to electrical signals
  - The optic nerve transmits the electrical signals to the brain for processing



# The Eye

- Vision is dependent on the light being focused on the retina and on the connection between the eyes and the brain:
  - If the light is not focused on the retina or the connection between the eye and brain are not well developed, the visual information that is sent to the brain will not be interpreted properly, and the image will be difficult to see.
- To see clearly the image needs to be focussed (refracted) onto the retina
  - 45 years or younger – assuming normal eye function, we can change our focus (accommodate) so near objects (<1m away) are clear
  - 45 years and older – lose the ability to change focus to see near objects (presbyopia)
    - Leads to extra strain/fatigue requiring increased effort to focus
    - Previously believed to be an eye muscle weakening issue but has been proven that the eye muscles maintain their strength. The lens in the eye gets larger and less elastic and is unable to change shape to change focus.

# Digital Eye Strain / Computer Vision Syndrome CVS

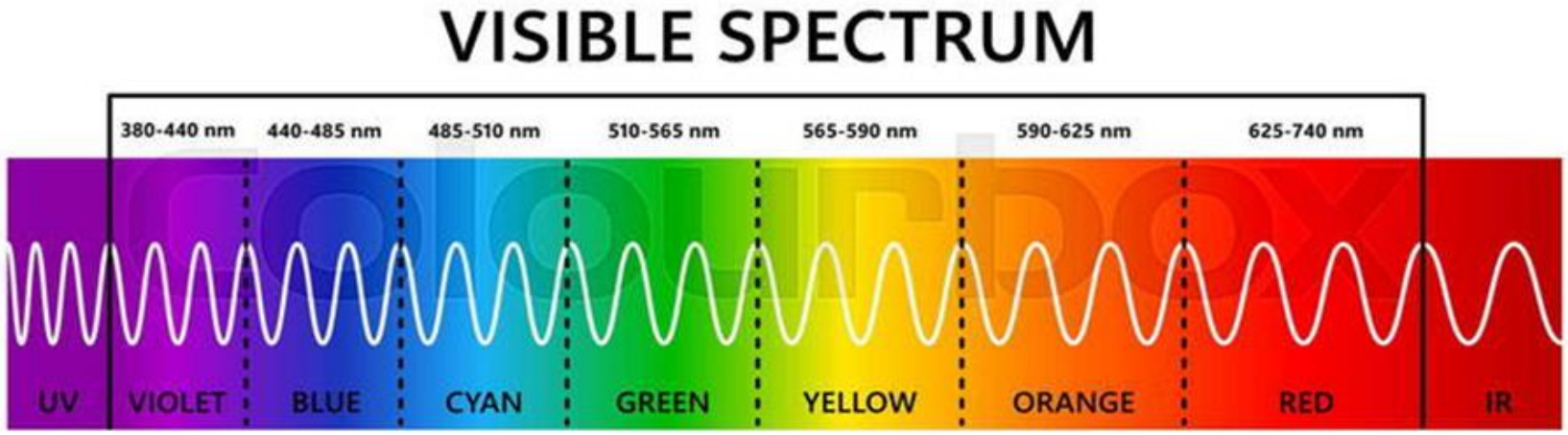
- Effects over 60% of computer users
- Group of eye related symptoms related to near work that occur while working on the computer.
- Includes eye fatigue, discomfort, dry burning eyes, headaches, blurred vision, neck and shoulder pain (poor posture)
- Risk Factors
  - > 4 hours of computer use daily
  - Poor lighting/glare
  - Dry environment (< 40% humidity)
  - Poor posture - Ergonomics

# Eye Strain / CVS Causes

- Difficulty seeing print (uncorrected refractive error)
- Decreased blink rate
  - Usually blink 15-20 times per minute
  - On digital devices ⟹ less than 5 times per minute
- Poor ergonomics is often related to improper vision correction – alter posture to see

# Blue Light?

- Most screens emit blue light <455 nm
- It **was believed** that prolonged exposure to blue light <455nm was damaging to the eye, however:
  - No evidence that blue light causes ocular health or retinal issues
  - No evidence that blue light leads to digital eyestrain or CVS
- It **does affect sleep patterns** if exposed prior to attempting to sleep
- The best blue light blocking coatings on glasses filter up to 30% of blue light under 455nm

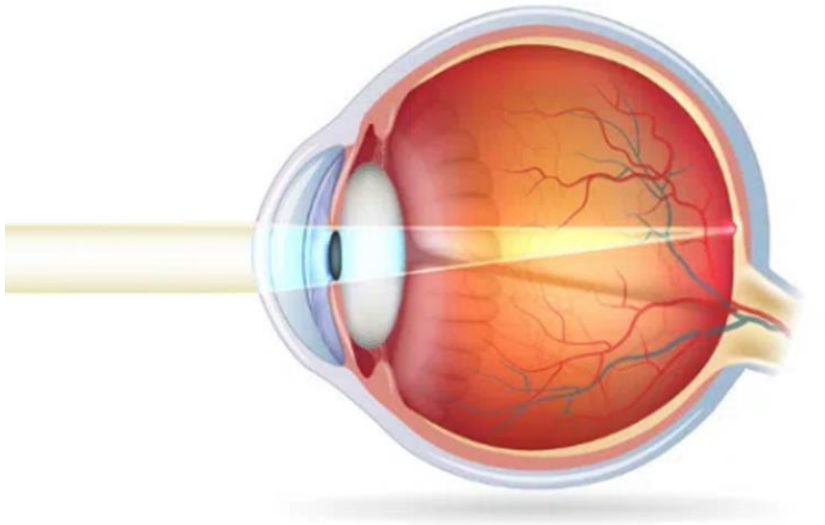


# How to Manage Eye Strain / CVS

- Correct Ergonomics
  - Set up to ease the effort required by the eye
  - Monitor height, distances, size, font size, etc.
- Decrease overall screen time
- 20-20-20-20 – updated to include eye moisture
  - 20 minutes
  - 20 seconds
  - 20 feet
  - 20 blinks – blink rate decreases when viewing screens
    - Or add moisture to the eye- lubricating drops

# Normal Vision

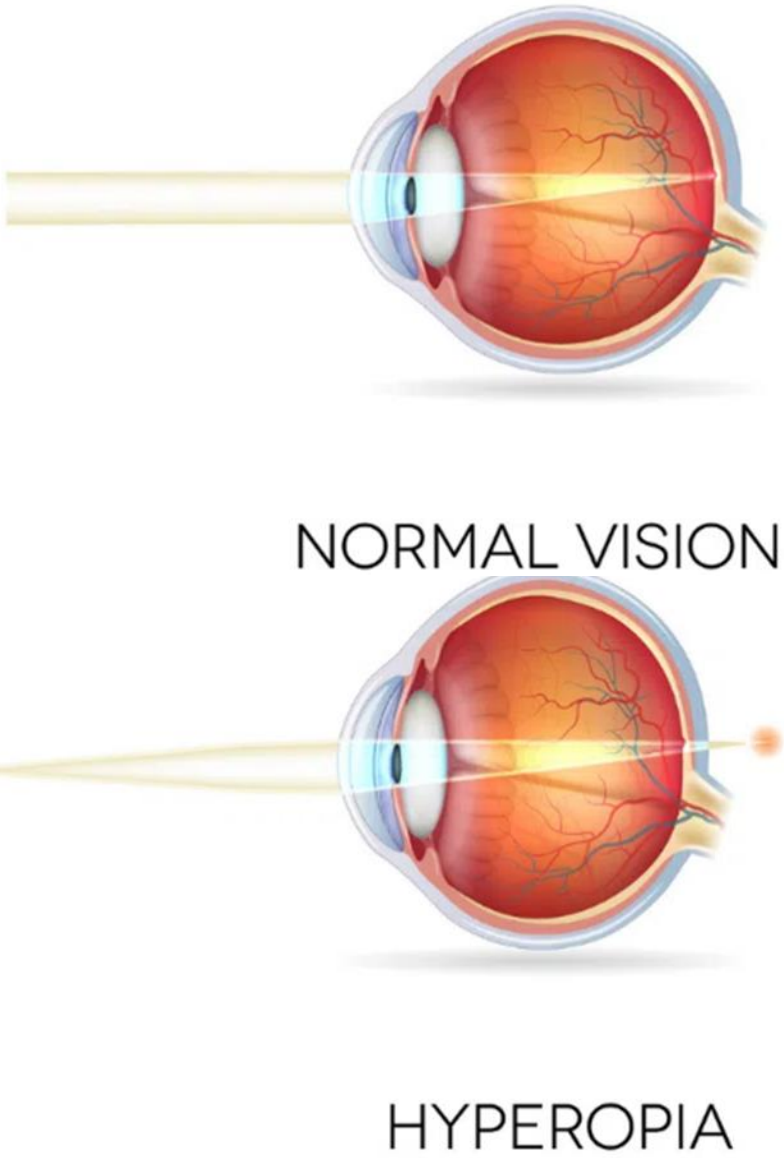
- Dependent on light rays converging precisely on the retina, a light-sensitive membrane at the back of the eye.
- The optical system of a normal eye, comprising the cornea, pupil and crystalline lens, orchestrates this precise convergence, ensuring that objects are projected sharply onto the retina.
- The process of light ray redirection is known as refraction.
- The total refraction of the eye is measured in diopters (D), representing the optical power of the eye. When the total refractive power of the eye matches the length of the eye, objects are focused flawlessly on the retina, resulting in sharp, undistorted vision.



NORMAL VISION

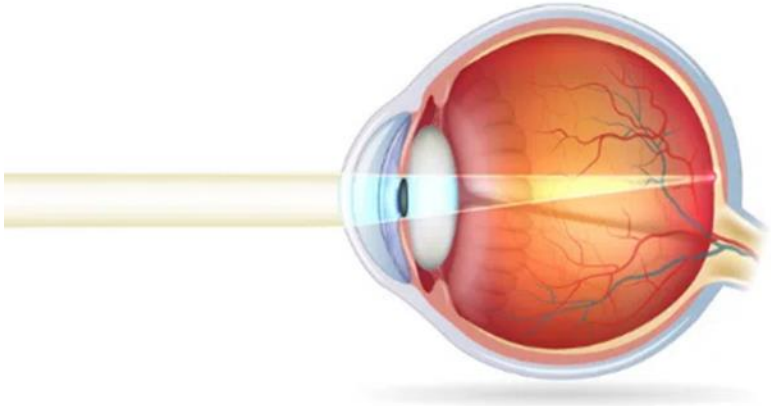
# Hyperopia (Farsightedness)

- Hyperopia typically stems from a shortened eyeball, causing the light rays to converge behind the retina instead of directly on it.
- Results in blurred vision, particularly for near objects.
- Distant objects may be seen clearly because the lens can change shape to increase the power of the eye and focus the light on the retina.
- If the increase in power required is more than the lens is capable of, an optical correction will be used to increase the overall refractive power of the eye, shifting the focal point forward onto the retina.

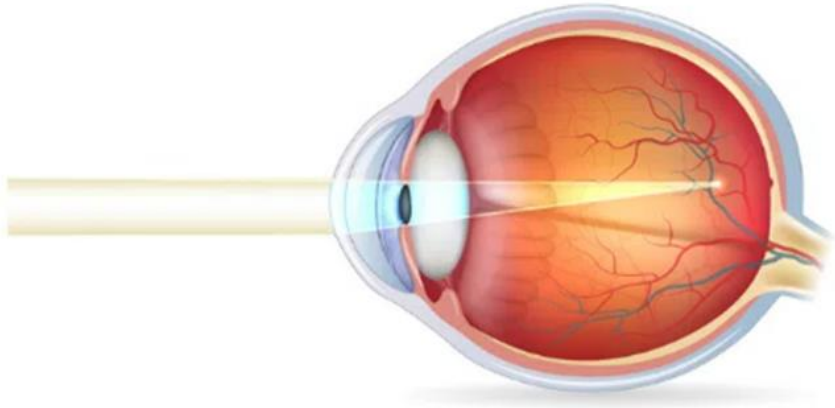


# Myopia (Nearsightedness)

- Myopia typically stems from an elongated eyeball, causing the light rays to converge in front of the retina instead of directly on it.
- Results in blurred vision for distant objects.
- Individuals with myopia often see well at near as the natural focal point of their eye is much closer than the blurry distance objects.
- Optical correction for nearsightedness reduces the overall refractive power of the eye, shifting the focal point back onto the retina.



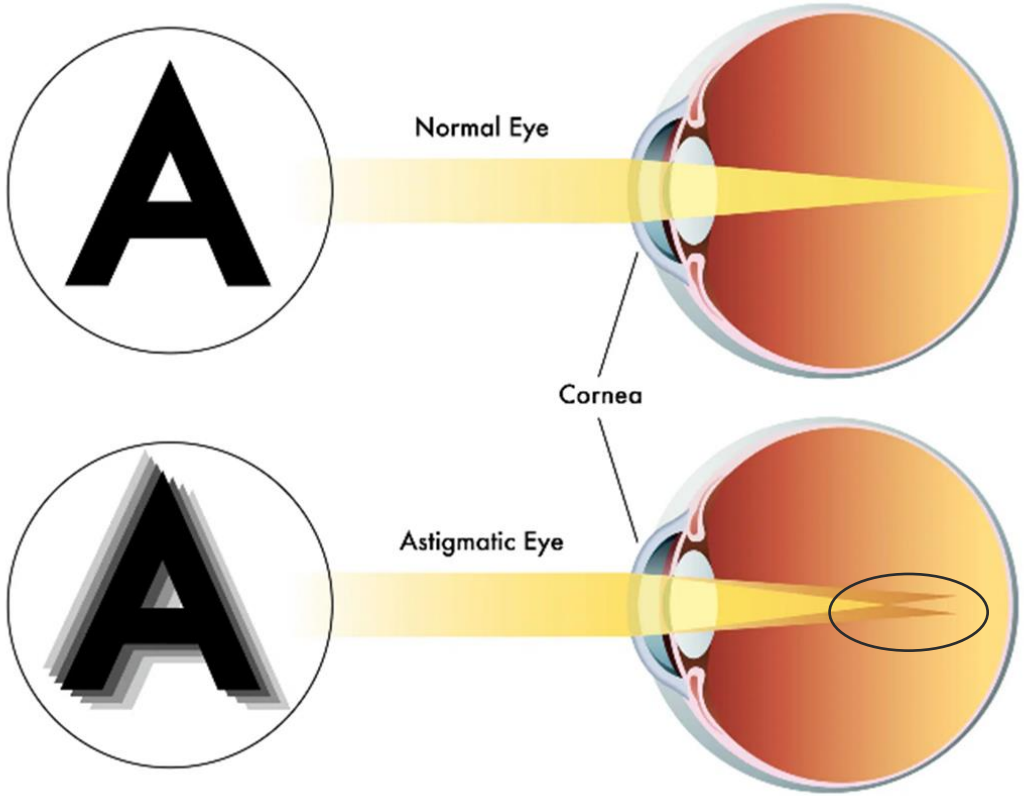
NORMAL VISION



MYOPIA

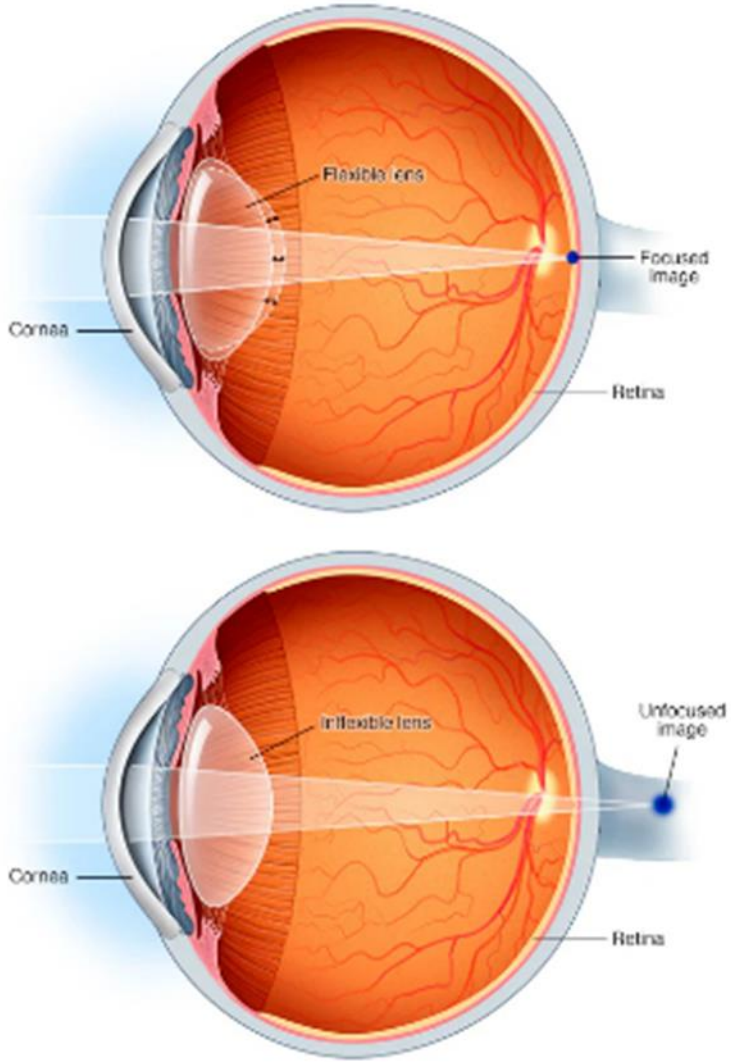
# Astigmatism

- Typically, the cornea has a smoothly curved, spherical shape like a soccer ball.
- With astigmatism, the cornea is more irregularly shaped, resembling an egg or a football. This causes light to focus at two different points in relation to the retina.
- The resulting distorted image often elongates images and may make a dot look like a line.
- Optical correction for astigmatism focuses both points on the same spot on the retina producing a clear image.



# Presbyopia

- Presbyopia is when your eyes gradually lose the ability to see things clearly up close.
- Normal part of aging. The term “presbyopia” comes from a Greek word which means “old eye.”
- The inflexible lens doesn't adjust to focus light properly, so the point of focus falls behind the retina.
- Start to notice presbyopia in your early to mid 40’s.
- Optical correction will increase the overall refractive power of the eye, shifting the focal point forward onto the retina.  This power will be different from the power required to focus the light from distance objects onto the retina.



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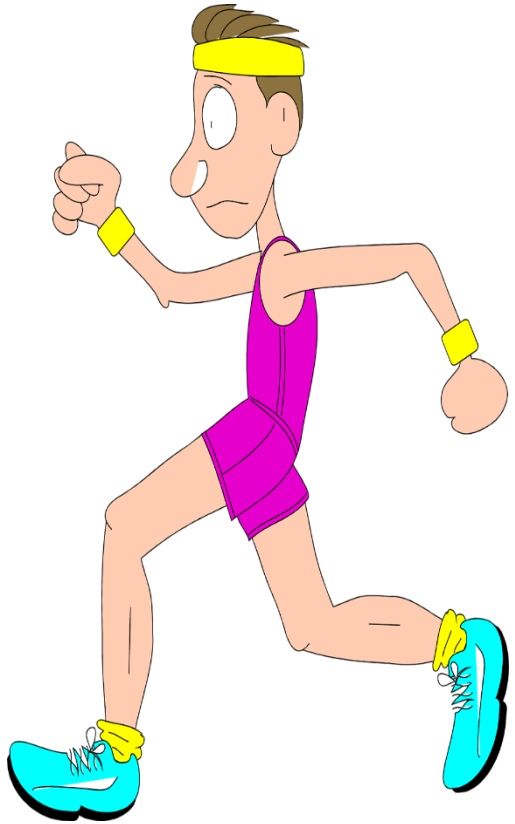


# Correction Options for Presbyopia

Four options

- Single Vision Near Lenses
- Bifocals
- Progressive Addition Lenses (PAL)
- Computer/Office Lenses

Any corrective lens option should have anti-glare/anti-reflective coating

# Single Vision Near Lenses

Only be prescribed for one distance

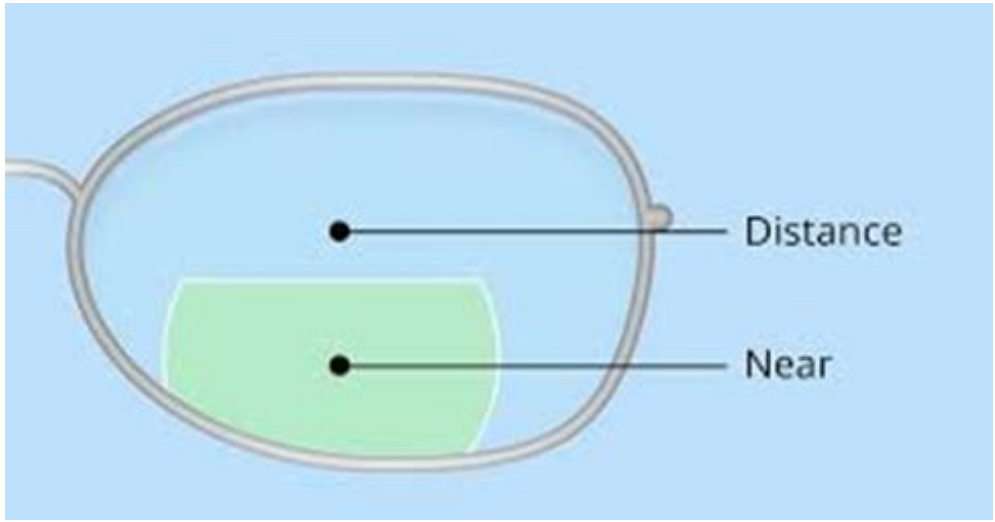
- Usually between 40-60cm viewing distance
- Monitor setup is generally 60-90cm
- If prescribed for 40 cm, will need to lean in toward computer monitor or move monitor closer → poor posture
- If prescribed for 60 cm or greater will struggle to see keyboard or read any near object → poor posture and/or eyestrain issues

# Bifocal/Trifocal

- Distinct areas to look through for specific distances
- Image jump when looking from one distance to another
- Potentially poor posture including tilting/tipping the head back is common

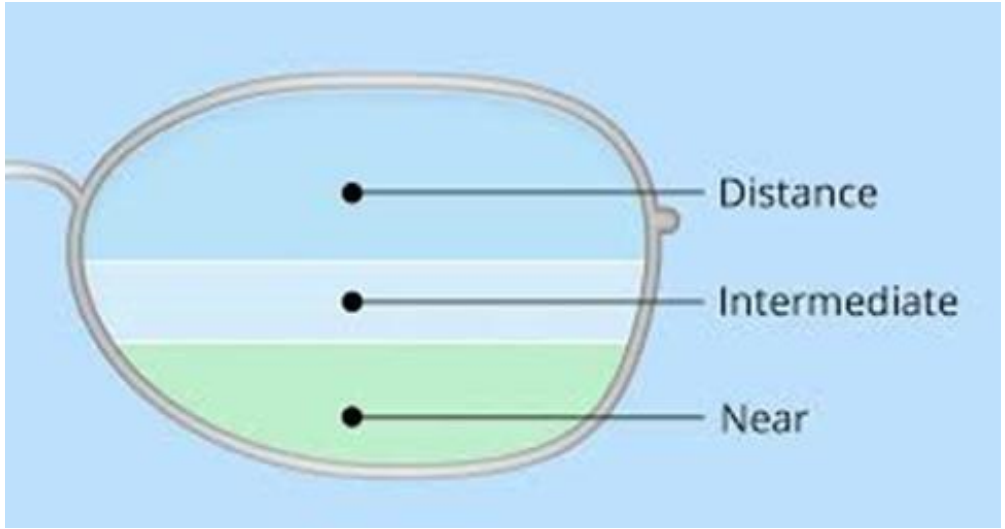
# Bifocal

- Bifocal has distance and near portion
- Bifocal has no area in it for computer (intermediate) distance
- Monitor needs to be lowered to avoid awkward neck posture



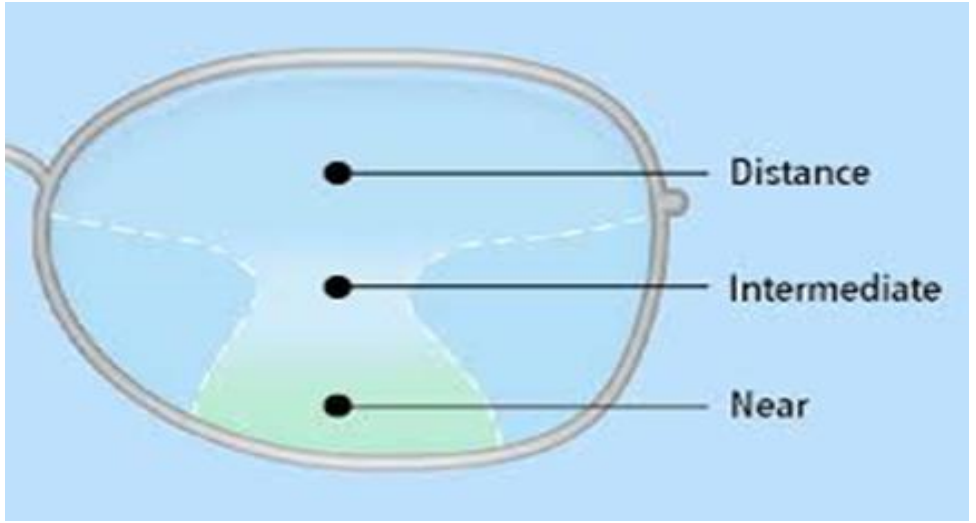
# Trifocal

- Trifocal has distance, intermediate, and near portion
- Trifocal has narrow strip for intermediate distance
- Limited area for viewing monitor – minimal flexibility for monitor height potentially leading to poor neck posture



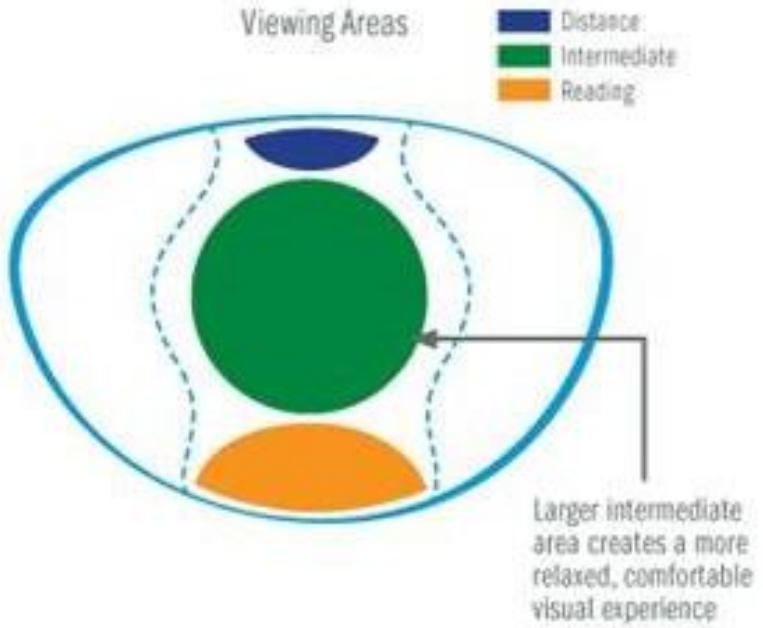
# Progressive Addition Lenses (PAL)

- Similar to trifocal but has ***blended areas*** of vision from near to far
- Traditional PAL are primarily distance at the top and near at the bottom with a ***smaller zone*** in the middle for the intermediate distance
- Even ***more limited*** area for viewing monitor – minimal flexibility for monitor height potentially leading to poor neck posture



# Computer/Office Lenses

- Similar to PAL, ***but*** the intermediate area is most of the lens with a smaller area for the distance and near.
- Intermediate add powers can be adjusted for different computer screen distances
- The best option when it comes to the computer or any task in the intermediate distance
- Allows for more neutral head position and neck posture



# Computer/Office Lenses

## VARILUX DIGITIME NEAR

The most natural way for your eyes to focus on your tablet or phone. Messaging your friends has never been so clear.

**The Lens**

Wide near vision zone at the bottom of the lens

Ultra near vision zone

Minimum depth of field of 80cm

## VARILUX DIGITIME MID

For everyday office screen life, not every lens allows for relaxed vision. Just think how many times you stretch your neck to focus on the screen. With Digitime Mid, you can work comfortably at your desk knowing your eyes and posture are relaxed.

**The Lens**

A wide intermediate vision zone

Ultra near vision zone

Minimum depth of field of 100cm is guaranteed for all prescriptions

## VARILUX DIGITIME ROOM

When you want to watch tv, you should be able to sit back and relax knowing your eyes are not strained. And when you get a text, you want to see it clearly without distortion. Thanks to Digitime Room, this is exactly what you get.

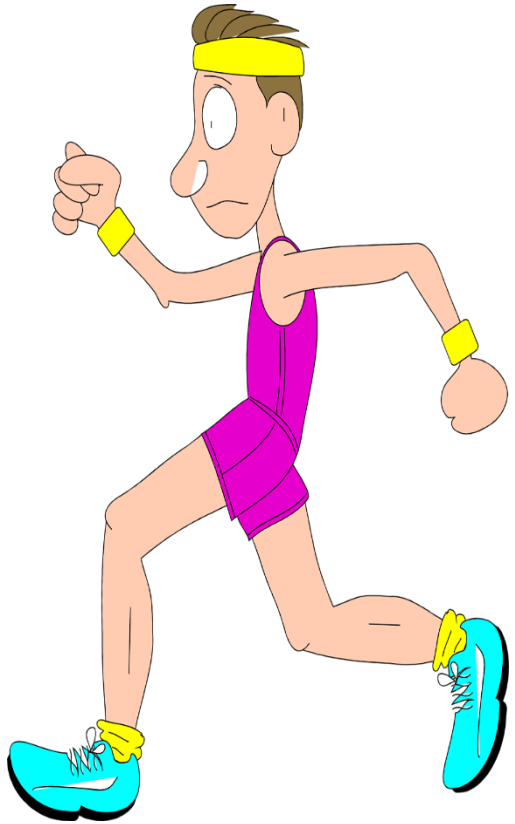
**The Lens**

A wide extended vision zone at the top of the lens

Ultra near vision zone

Minimum depth of field of 220cm

# Position and Eye Break: 20-20-20-20 (blink)



# Corrective Lenses and Ergonomic Changes

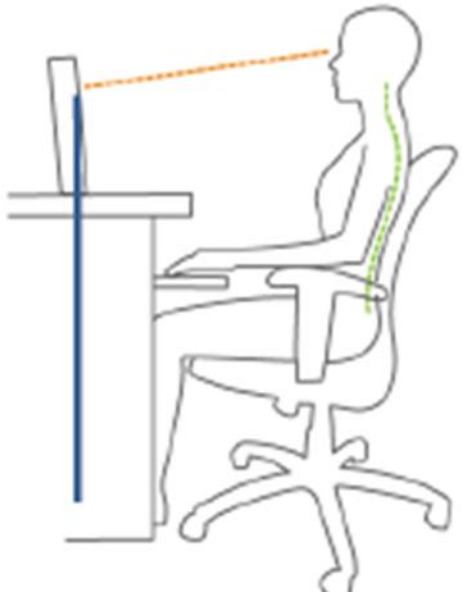
## Single Vision Near Lenses

- Monitor distance ***must*** equal prescription distance
- Very proficient at keyboarding – limited requirement to look at keyboard
- Works tasks must be considered – computer vs paperwork or combo
- Consider different type of lenses

# Corrective Lenses and Ergonomic Changes

## Bifocal/Trifocal

- Monitor must be set at exact height to hold neutral neck posture
  - Bifocal - monitor must be substantially lower than eye height
  - Trifocal - monitor usually not as low as bifocal but lower than usual
- Limited viewing range
  - Organize screen information within viewing area
  - May require further monitor distance to increase viewing area
  - Bifocal slightly larger range - bottom
  - Trifocal very limited range

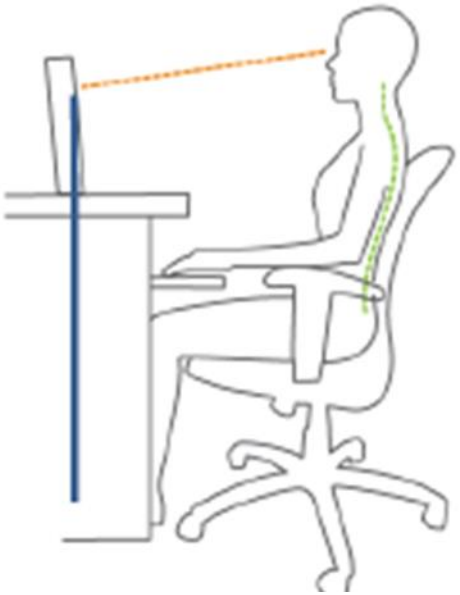


# Corrective Lenses and Ergonomic Changes

## Progressive Addition Lenses (PAL)

- Monitor must be set at exact height to hold neutral neck posture
  - Similar to trifocal - usually not as low as bifocal but lower than usual

- Very limited viewing range
  - Limit monitor size
  - Organize screen information within viewing area
  - May require further monitor distance to increase viewing area



# Corrective Lenses and Ergonomic Changes

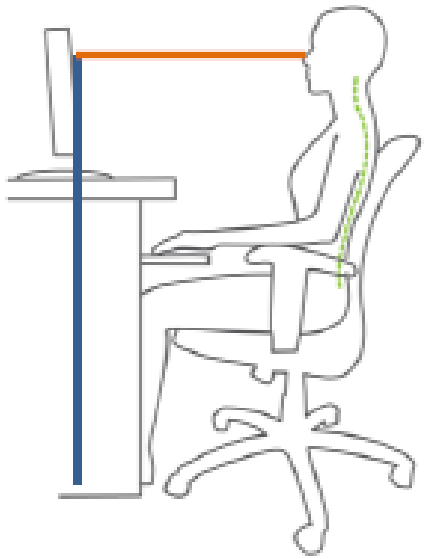
## Computer/Office Lenses

- Similar to PAL, ***BUT*** the intermediate area is ***most*** of the lens with a decreased area for the distance and near.

- Monitor can be set comparable to without lenses
  - Eye at top of viewing area

- Minimal limitations to viewing range
  - Intermediate lens powers can be adjusted for screen distance

- May require additional glasses for tasks requiring distance vision – walking, driving, etc.



# Summary

- Eyes lead the body
  - Poor Vision = Poor Posture = MSD
- Get regular eye examinations by an eye care professional
- Always set up computer components to allow neutral postures ***regardless*** of corrective lenses
  - Modify based upon type of lenses
  - Get assistance to check in needed
  - Evaluate regularly

**Position and Eye Break: 20-20-20-20 (blink)**

# Thank You

Questions?