

Visual Performance and Visual Aids in Taekwon-Do

A thesis presented to iTKD by Kishan Mistry in preparation for grading to IV Dan

Introduction:

The art of Taekwon-Do is dominated predominantly by three of the five main senses – touch, hearing and sight. If we focus on the sense of sight, this sense can be impaired in many ways. This could be due to common impairments such as myopia and hyperopia or more complex impairments due to pathological eye conditions. These “natural” impairments can potentially create some difficulties in the practice of a martial art such as Taekwon-Do.

Moreover, with the increase in frequency of digital services and technological advancements, there has been an increase in the rates of myopia worldwide which is correlated to an increasing amount of impairment, especially seen in the younger generation making many training activities difficult like watching and learning from an instructor. It is predicted that by 2050 close to half of the world's population will be myopic, an increase of over 60% or 1.5 billion people compared to today's population¹. In Oceania region, the most recent scientific papers have recorded that approximately 10% of the population suffer from myopia¹ with this figure expected to rise by about 150% by 2050. Of the approximately 3200 active members of International Taekwon-Do,² we could therefore statistically assume that approximately 320 members are myopic, with this almost tripling within a generation.

This is in contrast to presbyopia which symptomatically starts to affect people around the age of approximately 40 and on a day to day basis at about 50. Although this would not generally affect people in Taekwon-Do, if a person was emmetropic or hyperopic then this could cause significant impairment making training activities such as partner work difficult. The number of International Taekwon-Do members who are over the age of 50 sit at approximately 5% meaning we could therefore statistically assume that approximately 160 members are functionally hyperopic. These members also tend to be either instructors or parents training alongside their children, meaning being able to see small details in movements and critique others is an important aspect of their Taekwon-Do path.

Finally, eye problems are not always as simple as not being able to see far or close. It is not uncommon for someone to not be able to use both eyes correctly or be unable to filter out the irrelevant visual stimuli. Some of these conditions such as Irlen Syndrome can sometimes be misdiagnosed as a child who has Attention Deficit Hyperactivity Disorder (ADHD) who needs an external outlet for their energy.³ I would expect many instructors have seen children over the years who have behavioral problems and have struggled to teach them. These behavioral problems may have an underlying cause which if explored and correctly identified may improve the child's behavior. If an optometrist were to see the same child, it would not be uncommon to see a change in behavior simply by correcting their vision.

Assuming our organization does not grow (which is very unlikely), statistically 1 in 6 members will have a vision impairment within a generation. This paper will explore the different types of impairments in more detail, the different ways to correct them, seeing how these impairments could affect a member, whether there is an ideal way to correct it, and whether this affects iTKD / ITF at the end of the day.

Common Impairments Categories and their Effects

Myopia could be considered a neutral impairment towards some aspects of Taekwon-Do. Small amounts of myopia or approximately -1.00 Dioptre Sphere (DS) could be considered advantageous. At this point, the person's (assuming normal accommodation) point where everything is clear (focal point) would be at one metre exactly. Take into consideration the Depth-Of-Field (DOF) and you would have relative focus between about 70 cm and 180cm⁴ - the distances that a practitioner would be focusing at when doing patterns techniques and partner work like sparring.

Presbyopia in emmetropic people would normally be of no consequence. Technically, presbyopia occurs in everyone regardless of age. Children tend to have large accommodation reserves so tend to not notice the effects of the weakening accommodation. It can be calculated that a person would have no accommodation at the age of 60.^{5,6} Therefore, we can calculate that at the approximate age of 50 is when those who are emmetropic might start to find focusing on the technique focus area difficult. It would be earlier in people who are hyperopic as these people use the lens to make the distance clear as well as close up. Generally presbyopic people would be the opposite of myopic people - they would find focusing close up difficult. Depending on the amount of hyperopia and age, hyperopic people could find both near and distance aspects difficult

Amblyopia would make all the physical aspects of Taekwon-Do we are looking at difficult. This is because with one good eye, the brain often suppresses the bad eye as it is not presenting any useful information that can be used. This leads to monocular vision leading to the major disadvantage of a lack of depth perception. There are other ways for people with amblyopia to gain depth perception such as bobbing their head forward and backward (which could be useful in free sparring), but lack of depth perception would normally be considered a disadvantage. The good eye is then relied on for most tasks. On top of having only one good eye, this eye could be either myopic, hyperopic or emmetropic.

There is also an 'other' category for eye conditions. These conditions are much rarer than the first three categories explained. One such condition is Irlen Syndrome. By removing and reducing certain wavelengths of light, a person with Irlen syndrome can show improved concentration as it decreases the amount of information that the brain has to process. There are different reasons as to why optometrists think this is the case as the aetiology of Irlen Syndrome is not fully known yet.⁷ For the purposes of simplicity, whenever we talk about this category, we will only be talking about Irlen Syndrome.

Impairment Correction Methods

Myopia and presbyopia are very easy to correct in many different ways as these are very clear-cut impairments in most cases. There are three main ways that someone can correct this impairment - using prescription eyewear, using prescription contact lenses or having corrective surgery. Amblyopic correction can be corrected using the same methods but is often more complicated with some correction methods being better than others depending on the condition.

Prescription Eyewear:

For a person with myopia, they would be able to put on prescription eyewear and be able to see clearly far away. As long as this person had sufficient accommodation, then they would also be able to see close up while wearing their prescription eyewear.

For a person with presbyopia they would be able to put on prescription eyewear and be able to see clearly close up. However, this would make their distance vision blurry so would have to wear prescription eyewear which would allow them to have unhindered (or corrected) clear distance vision and clear close vision.

For a person who has amblyopia, correction of the underlying prescription is required. The underlying prescription can vary in size, and may contribute to straightening the eye (via prismatic movement) if there is an eye turn so that both eyes are straight and the person has binocular vision.

For a person with Irlen Syndrome, coloured filter eyewear is usually required. This helps to remove the excess information going to the brain so the person can make decisions based on a 'normal' amount of information i.e. the information that a person without any conditions would get. This is the only way to help correct this condition.

Contact Lenses:

For a person with myopia, they would be able to put on prescription contact lenses and be able to see clearly far away. These contact lenses may not be as clear as the prescription eyewear, however would be adequate in giving functional vision. As long as this person had sufficient accommodation, then they would also be able to see close up while wearing their prescription contact lenses.

For a person with presbyopia they would be able to put on prescription contact lenses and be able to see clearly close up. However, this would make their distance vision blurry so would have to wear prescription contact lenses which would allow them to have unhindered clear distance vision and clear close vision. These contact lenses may not be as clear as the prescription eyewear, however would be adequate in giving functional vision. They could also consider wearing a prescription contact lens in their non-dominant eye, so one eye would be able to see clearly in the distance and one clearly close up (monovision correction).

For a person who has amblyopia, correction of the underlying prescription is required. These contact lenses may not be as clear as the prescription eyewear, however would be adequate in giving functional vision. However, there would be no prismatic movement of the eye so it would be less useful for people with some conditions such as those with eye turns.

Surgery:

Like all surgeries, there is always a risk of things not going to plan. These outcomes are assuming there are no major complications before, during or after surgery.

For a person with myopia, surgical correction (e.g., Lasik Surgery) is a method of correction that would generally allow the person to have unhindered distance vision. As long as this person had sufficient accommodation, from a visual point of view they would be emmetropic.

For a person with presbyopia, surgical correction (e.g., multifocal lens replacement surgery) is a method of correction that would allow the person to have unhindered distance vision and close vision. This visual outcome after surgery may not be as clear as the prescription eyewear, however would be adequate in giving functional vision.

For a person who has amblyopia, the surgery can be used for correction of the underlying prescription. In some cases, it can also be used to help realign the eyes or correct some underlying pathology.

Corrective Method Consequences

Naturally, all types of correction are positive and help to correct vision in some way or another. However, each method has its own consequences and sometimes one method of correction is better than another. These consequences can be the reason why one method of correction is more preferred by someone than another.

Prescription Eyewear:

The most obvious disadvantage to prescription eyewear is the fact that there is another object on your face that can potentially move around and distract you. In many cases this is due to a bad choice in frame design and poor fitting of the prescription frame and can be fixed to an extent. However, when doing exercise the eyewear can slip due to sweat making the nose and bridge slippery. This leads to a classic movement of pushing the eyewear up the nose. This could easily be fixed with a sports band that fixes the eyewear to the face or sports-specific safety eyewear and removes the potentially dangerous situation of the eyewear coming off and causing injury to another person.

Eyewear can also change what you see around you in terms of size and Field-Of-View (FOV). A lens used to correct myopia increases the FOV as there is a slight decrease in the size of the world around. The stronger the power, the more the decrease in size. A larger FOV might be more beneficial, however the smaller image size (looking through prescription eyewear puts the image from the lens onto your eye so what you see is an image of the world) may be detrimental. The same is with hyperopia but in the reverse (decrease FOV and increase in size). Presbyopia correction would have the added consequence of having either image jump due to the bifocal window or soft focus in the periphery due to the progressive corridor.

This biggest advantage to wearing prescription eyewear as a method of correction is that many of the more obscure conditions that can cause amblyopia are best corrected with prescription eyewear due to the prismatic effect the lenses have on the eyes. A smaller 'silver lining' advantage to wearing prescription eyewear is that you effectively have an eye shield in front of your eyes. Any strikes or thrusts aimed directly at the eyes have a small barrier in the way and are the most impact resistant corrective method (by default as no other corrective method can provide impact resistance).

Contact Lenses:

The disadvantages stated above with prescription eyewear are generally solved by switching a person into contact lenses. There is nothing to distract you on your face that could move around and the lenses only provide a prescription correct with no significant change to the world around you. The only exception to this is if someone was to try monovision correction. Clarity wise would be adequate, however as both eyes are seeing different images they wouldn't be working together and as such you could lose binocularity and depth perception.

Contact lenses provide their own set of problems. This is because contact lenses are a small piece of plastic that is put on the cornea of the eye. The contact lens acts like a barrier to reduce the tear spread over the cornea itself. A small amount of tears are squeezed under the contact lens and on the cornea with the rest creating a new tear layer created on top of the contact lens. With less tears on the cornea, the cornea is unable to be kept as moist and has a reduced amount of oxygen exposed to it. This can lead to small side effects such as dryness and needing to blink more frequently to more extreme side effects such as neovascularization (blood vessels being formed on the cornea which is a clear structure) and contact lens intolerance (not being able to wear contact lenses indefinitely). There are also health conditions and

medication which can make wearing contact lenses more difficult. Common examples of this are things such as menopause and acne medications (oil composition in the eye changes).

Surgery:

The biggest risk of surgical correction is the fact that at the end of the day it is still surgery and there is always a risk of complication. Refractive surgery is one of the safest surgeries out there that a person could have⁷ but the person is still at risk of common complications and side effects, definitely short term but also potentially long term. The most common side effect is dryness of the eye due to the corneal nerves being exposed post-surgery and constantly being activated. This often does subside but can last for potentially years.

Other than the inherent risks of surgery, if everything goes to plan then you are emmetropic and can act like an emmetropic person in terms of vision with no other visual consequences.

Use of the Eyes in Taekwon-Do

Patterns:

It is often explained to a student that the techniques that are being done in a pattern have an application as is shown in the Encyclopedia of Taekwon-Do.⁹ A simple example would be a forearm low block being used to block a front snap kick. Phrases like “Do the movement like you mean it” or “Pretend you are blocking an attack coming towards you” helps make the student understand that they have to imagine an opponent in front of them either attacking or blocking them.

We know that we would want to be simulating a structured fight so our eyes should be focusing at multiple distances, depending on where the attack is coming from and where the point of impact should be. Specifically between our body and just outside the reach of legs when we are kicking. On average this would be approximately a distance of one metre.

Free Sparring:

Free sparring is almost the opposite of Patterns. We don't have an obvious idea of what techniques is going to be thrown and where the technique is coming from. Hence, we need to judge this by looking at the opponent as a whole and determine whether a block or dodge is appropriate. If this does not happen, there is a real consequence of getting hit.

Because of this we cannot just assume with our eyes and tunnel vision into a certain part of the opponent. As such, creating a situation where the student has a large FOV by scanning the opponent's whole body, taking notes of little triggers like the movement of the shoulder prevents the tunnel vision like effect from taking place.

Step Sparring:

Step Sparring is the happy medium between Patterns and Free Sparring. Like Free Sparring, it involves the use of a partner and requires the eyes to be able to bring the attacking or blocking tool into focus and accurately counter the opponent. The eyes also need to be able to see the opponent in general to be able to determine the timing for their technique.

However, like Patterns this exercise makes it simple to do this as the attack is predetermined meaning it is obvious where the attacking tool is coming from and where the person will end. As such, it is a good training tool to teach students how to effectively use their techniques. It also lets them get their distance and timing

right by taking into account the opponents full body and motion. If they are unable to do so, depending on the level of control they may get hit.

Self Defense:

The awareness and de-escalation aspects of self-protection prior to any physical activity requires active scanning of the environment prior to any interaction, trying to keep as wide a FOV as possible to be aware of things such as surrounding environments and threats. Even when confronted, the eyes need to be used effectively at assessing the situation and giving a passive non-threatening vibe. An angry face is more threatening and is more likely to escalate violence compared to a neutral non confronting face.¹⁰

The coloured belt syllabus is designed for only one attacker. As such, while being attacked and releasing the eyes only need to focus on the opponent attacking and the vital spots that the student would potentially counter. The black belt syllabus allows more flexibility in regards to the range of motions and number of attackers, meaning that the student not only needs to practice multiple techniques, but have a large FOV and use scan their surroundings so they can see where the attack is coming from, keeping in mind the positions of the other possible threats, cameras, exits etc. These are the same skills required for the tactical disengage learnt in the coloured belt syllabus.

Destruction and Special Technique:

These aspect of the martial art are quite different from a visual point of view as this is the only aspect where concentration on a single point is all that matters. In destruction the target boards do not pose any threat to the student. In this regard, more tunnel vision (narrow FOV) would be wanted to block out any distractions including those who are watching and the board holder. In special technique, a slightly larger FOV would be required as you need to keep an eye on the run up area or bar / ribbon that a competitor would need to jump over.

Destruction would generally require better close vision as when you are breaking you often are with a meter or two of the boards. Special Technique would generally require good distance vision as there is often a run up of a few meters. Both would also require good depth perception, as both need to move towards the boards and be able to judge when to start executing the technique to make contact with the boards.

Competitive Taekwon-Do and Vision Correction

Tournament participation is a large part of some students' Taekwon-Do journey. At some point, the student would likely compete whether it is for the experience and the thrill or because they need the credit point for their black belt grading. In lower level tournaments such as Club or Regional tournaments, rules regarding approved clothing and safety equipment are relatively relaxed compared to the highest level of competition (like a National or International tournament).

In all the areas of competition, we will only be looking at the difference between prescription eyewear and contact lenses. Surgery is excluded as this is a method of correction having no consequences in regards to tournament regulations.

Patterns:

In a tournament setting, competitors are spread out in such a way that theoretically there should be no contact between them. If there was to be contact, there are also rules in place to determine who is at fault. As such this can be considered a non-contact event. If someone was to wear prescription eyewear (especially with a sports band which can come in multiple colours and hidden underneath hair), then it is

very unlikely that the person would have to deal with any problems and cause problems with the other competitor. If someone was to wear contact lenses, then they could put in contact lenses to focus in the one metre area around them by changing the power of the contact lenses they order. This could potentially be considered an advantage as the competitor could 'force' themselves to focus on their techniques.

Sparring:

A very simple category for obvious reasons. Prescription eyewear are a less favorable correction method as contact with prescription eyewear risks the eyewear breaking causing headaches (both literally and possibly financially) for both yourself and the opponent. Even contact sport specific safety eyewear that are flatter may not be as favorable. This is because although from a contact point of view should be safe, the unspoken 'gentleman's agreement' that happens in club training may occur in the ring, meaning the face is a target less likely to be hit. Contact lenses would be the go-to method here. However, when there is contact with the face and specifically the eyes, there is a small chance that one or both of the contact lenses come out. If this were to happen it would likely penalize the competitor as they would lose some depth perception making it harder to spar. Depending on the amount of impairment, it might even be better to spar without any correction to avoid this problem.

Destruction:

Once again, this is a non-contact event so whether one correction method is better than the other would depend on whether one provides some sort of advantage. Boards are held by a breaking machine with a very obvious middle line where the boards break. This point would be seen quite easily regardless of the correction method. We know that the force required to break a board is relative to mass and velocity. The weight of a pair of prescription eyewear on the heavier side is only about 45 grams or about the weight of a shot of water. For a 50kg person this is less than 0.1% of their total body weight. At a competitive level where multiple polar boards are being broken, the contribution of mass that comes from the prescription eyewear would be negligible. As such either vision correction method would be viable.

Vision correction would be better than no vision correction as the correction would help seeing the middle line of the boards easier. A deviation of only 10 mm from the centre line increases the amount of power required to break boards (though minimally). Consequently, being able to see and concentrate on the correct point would be beneficial.¹¹ If one wanted, they could also correct their vision to the exact focal length of the board with contact lenses. This may provide a benefit with hand techniques especially as your distance from the board and head is much more stable.

Special Technique:

Another non-contact event. Similar to Destruction where the increase in weight that the eyewear would provide would be negligible. Vision correction would make it easier to see the board and judge the distance from your starting position as you approach it. As such either vision correction method would be viable. Unlike in Destruction, correction would want to be only for distance vision as to avoid depth perception problems when approaching the boards. Both eyewear and contact lenses would provide the same level of vision correction here.

Current iTKD / ITF Tournament rules and Possible Amendments:

The current tournament rules which restrict the use of any type of eyewear (not contact lenses as these are not visible) or the consequences they could have on competition are found in section T7, T26, T44 and T47.^{12,13,14}

T 7. Safety Equipment and Protective Wear

ITF - Safety equipment must be of an approved type and certified by the Board of Directors. Approved Equipment shall be indicated in the World Event official invitation letter and ITF website

iTKD - The following brands are the only permitted Safety Equipment: a) Top Pro b) Top Ten c) Fuji Mae d) Grand Marc e) Mighty fist f) Adidas g) Nikko h) Maxpro i) Martial Arts Depo (MAD)

If safety eyewear was to be allowed to be used, this would be the first 'hurdle'. It would be a small hurdle though as the ITF wording is broad enough to have safety brands included just by adding to the ITF website. The iTKD wording is a little more constricting but there are a couple of ways around it. The first and easiest is not changing anything. Adidas already have a sports safety range, and this could be an opportunity for other accredited brands to expand their equipment range. The second is to include more well-known safety brands such as Oakley and Bolle as permitted brands. This could become an opportunity for iTKD (and even for ITF) for a cooperative sponsorship agreement.

All protective safety wear must be of an approved type (see above) consisting of elasticised material with sponge or rubber type padding and containing no metal, bone or hard plastic (except for groin guards and breast protectors). The use of zip, lace or stud fasteners is forbidden

Safety eyewear is made of hard plastic so an exception for safety eyewear would have to be made. As such if there were to be an amendment, the wording would need to change to "... *hard plastic (except for **approved safety eyewear, groin guards and breast protectors**).*" Once again, the change could only be made once it is proven that safety eyewear does not change sparring habits.

No jewellery, watches or other adornments may be worn. Hair may be kept in place using a material of a soft elastic nature only, no hard material, metal, grips or slides are allowed

Prescription eyewear is mainly limited by this rule. By definition, prescription eyewear should not be considered an adornment as its primary purpose is to correct a visual aid and a secondary consequence of this is being an adornment.

There are two ways to amend this without creating exploitable loopholes. The first is to add a sentence in the current rule allowing the use of prescription eyewear. The rule would be amended as follows: "*No jewellery, watches or other adornments may be worn. **Prescription eyewear may be worn for non-contact events.** Hair may be kept in place using a material of a soft elastic nature only, no hard material, metal, grips or slides are allowed*". The second is to make a completely new, standalone amendment that allows the use of prescription eyewear and its condition's in full. Its wording would be as follows: "***Prescription eyewear may be worn for non-contact events. They must be securely attached to the competitor's head at all times when in the ring. The eyewear are solely the responsibility of the competitor and acts as an extension of the competitor's body.***"

T 26. Eliminations - Individual

In the event that two competitors clash (come into contact) during the performance of their pattern, the competitor that is found to be responsible for the clash will receive a score of zero (0) points for that pattern.

In a non-contact event, if the eyewear was to make direct contact with the opposing competitor it is clear that the owner of the eyewear would be at fault and automatically score zero. However, in a situation where the eyewear falls to the ground and the opposing competitor is to make contact with, it could be argued in different ways. The first is that the opposing competitor is deliberately making contact with the eyewear and

not moving around it which means that the person responsible for the clash is the opposing competitor. The second is that the eyewear should not have been there in the first place and that any movement around the eyewear / contact with the eyewear is the responsibility of the owner of the eyewear.

Making the eyewear the sole responsibility of the competitor who uses it makes it very clear that any contact to do with the eyewear is the fault of the owner. This prevents the owner from blaming the opposing competitor for any contact with the eyewear. One could argue that the opposing competitor could deviate from their path and deliberately make contact with the eyewear and that is the fault of the opposing competitor. In this situation, it would still be the fault of the owner of the eyewear as the eyewear should not be on the ground in the first place. The opposing competitor should lose 0.2 points for every technique that was performed incorrectly in the process of making contact and 0.2 points for every future consequence of this deviation such as not finishing on the starting position, incorrect stances to get back to correct position etc. This example ignores the moral character aspect of Taekwon-Do.

T44 Power Procedures and T47 Special Technique Procedures

T44 - must include one (1) pre-judgement of distance with touching allowed, followed by the attempt to break the board(s) ... Referees may disallow an attempt for failure to maintain the following: More than one measure

T47 - must include one (1) pre-judgement of distance with no touching allowed, followed by the attempt to move the board

If eyewear is allowed in competition and for some reason it were to come off the face and make contact with the boards, one could argue that when the eyewear touched the board, it contributed to breaking the boards. Making the eyewear an extension of the competitor's body eliminates any ambiguity that could be ruled. It makes it clear that if the eyewear were to come off and make contact, it would be considered as a touch. Making it the competitor's responsibility to keep their own eyewear on their face makes it easy to accept this interpretation.

Vision Correction Summary:

In all aspects of Taekwon-Do, if a person has a visual impairment that requires some sort of visual correction, they should use a visual aid to correct it when training. For those who already have some sort of visual aid, there are pros and cons for all types of correction they have and the type they could have. As such, whatever type they have currently or (if they have multiple types) whatever type is most comfortable should be used.

For those who are going to get some sort of vision correction or from a competitive angle, other than in sparring, there is no obvious difference between vision correction methods in a tournament setting. Both prescription eyewear and contact lenses would be practical to use. There may be a theoretical advantage in using contact lenses to fix the focus point of the eyes in a specific area in patterns and destruction, but more research would need to be done.

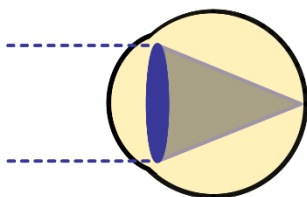
There should be no restriction (except for in sparring until more research is done) as to what type of visual aid is used to correct vision and there is no reason a rule amendment allowing the use of non-safety prescription eyewear could not be put in place.

I would recommend adding one amendment only to Section 7 of the tournament rules. This would be a standalone amended word exactly as follows:

Prescription eyewear may be worn for non-contact events. They must be securely attached to the competitor's head at all times when in the ring. The eyewear are solely the responsibility of the competitor and act as an extension of the competitor's body.

Sports-specific safety eyewear could also be considered for use in sparring, however more research is required to determine whether this would adversely change a competitors sparring habits. As such, any amendment in this regard would need to be looked at in more detail and I cannot recommend any changes as of yet.

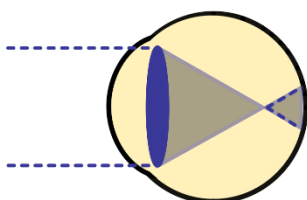
Important Eye Related Concepts / Glossary:



Emmetropia:

Emmetropia is the 'normal' state of the eye where the eyeball is the perfect length and the cornea has the perfect curvature. This causes the image of an object entering the eye to be in perfect focus and sit on the retina, resulting in a clear image.

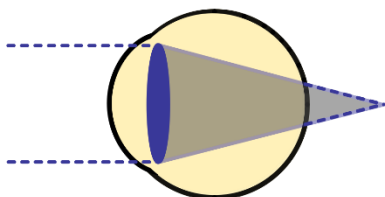
Emmetropia. Image created August 3 2020 by Sasheen Dowlath from Sasheen Dowlath Photography.



Myopia:

Myopia (also known as short-sightedness) is a condition of the eye where either the eyeball is too long or the cornea is too curved. This causes the image of an object entering the eye to be out of focus and sit in front of the retina, resulting in a blurry image beyond the focal length. It is often caused either by having a genetic predisposition and/or their environment (spending lots of time on close up activities such as computers, phones as well as being indoors a lot)

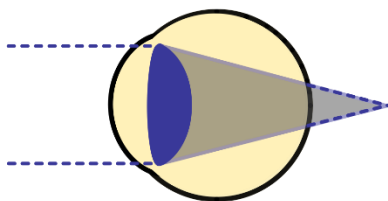
Myopia. Image created August 3 2020 by Sasheen Dowlath from Sasheen Dowlath Photography.



Hyperopia:

Hyperopia (also known as long-sightedness) is a condition of the eye where either the eyeball is too short or the cornea is too flat. This causes the image of an object entering the eye to be out of focus and beyond the retina, resulting in a blurry image. The lens of the eye may be able to contract to bring the image onto the retina resulting in a clear image. As such, many hyperopic people act functionally as emmetropic.

Hyperopia. Image created August 3 2020 by Sasheen Dowlath from Sasheen Dowlath Photography.

**Presbyopia:**

Presbyopia is a condition of the eye where the lens gets weaker and is unable to contract / change shape as well. This reduced contraction makes looking at close objects more difficult. Many people recognize this as the point at which they need reading glasses for more tasks than just reading print.

Presbyopia. Image created August 3 2020 by Sasheen Dowlath from Sasheen Dowlath Photography.

Accommodation:

Accommodation of the eye is the amount that the lens of the eye can contract to allow the eye to see close up. When the lens gets stiff and is unable to do so, this is a reduced amount of accommodation and leads to presbyopia.



Accommodation (eye) (n.d.). In *Wikipedia*. Retrieved July 26 2020, from [https://en.wikipedia.org/wiki/Accommodation_\(eye\)](https://en.wikipedia.org/wiki/Accommodation_(eye))

DS:

DS stand for Dioptre Sphere. It is the unit of measurement for correcting a person's vision. The reciprocal of any DS is the focal length of the eye. If it is negative, there is a real focal length (in front of the eye). If it is positive, the focal length is imaginary (behind the eye).

Amblyopia:

Amblyopia is usually when one (but can be both) of the eyes have reduced vision even with correction. This is because the connection between the eye and brain was not fully made. This could be due to pathology, asymmetric vision or pure luck.

Field-Of-View (FOV) and Depth-Of-View (DOF):

FOV refers to the area that someone is able to see. The most commonly known version of this is when you have tunnel vision (narrow field of view). DOF refers to how far or close someone can see from a point that is in focus. This concept is seen in photography where when the aperture size decreases the DOF increases. Within the eye, the aperture is synonymous to the pupil.

FOV is inversely related to the DOF (narrow FOV would have a large DOF and vice versa.)

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