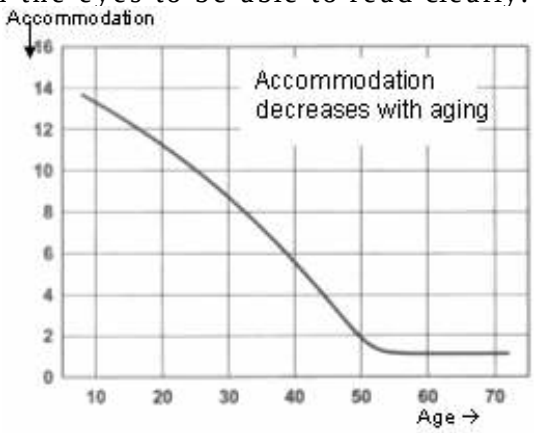
AgingEye Times



**Accommodation** is the process by which the eye increases its power to enable clear near vision. To understand accommodation process let us compare the eye with a camera. To take sharp pictures we have to focus the camera on the object of interest. In the camera focusing occurs by a moving the lens forwards or backwards. In the eye the lens position is fixed. Therefore to focus on a near object, a change in the shape of the lens occurs which increases its power.

The extent to which the lens power can be increased with accommodation decreases with aging. When a person is unable to focus on near objects because of insufficient accommodation ability, then '**Presbyopia**' is said to have set in. This usually happens after 40 years of age and manifests as inability to read comfortably. Adolescents can accommodate up to 14 D, which means they have the ability to read as close as 7 cm from the eyes. By age 45, the accommodation ability drops to about 4 D, which means one would have to stretch the hands to 25 cm from the eyes to be able to read clearly. Normal reading distance is considered to be about 35 cm (14 inches), so at age 45, the 25 cm distance may seem fine. However, since the eyes have to accommodate to almost their full capacity, you would tire easily and prolonged reading would be uncomfortable. In the early stages of presbyopia, one is able to stretch the arms to read, but eventually help in the form of reading glasses becomes necessary. . Reading glasses start helping at this point. After age 50 the accommodation drops to only 2D, which means you can only read at 50 cm or beyond and not any closer than that. This distance is definitely out of reading distance range and reading glasses become a necessity for up close work. (Note: the above applies to you only if either you need no glasses at distance or have been corrected with adequate glasses for distance)




A presbyopic eye loses its innate ability to clearly see all objects that are located at different distances. It can see some objects clearly but not all. In individuals who are less than 40 years of age, the eye can be thought of as an 'auto-focus' cameras. In an auto-focus camera, all one has to do to get sharp pictures is to point the camera in that direction, the auto-focus mechanism kicks in and you get sharp pictures. After age 40, the presbyopic eye can be thought of as a 'fixed-focus' camera. Fixed-focus cameras, the most basic of all cameras, have a nonadjustable lens. In general, a fixed-focus camera can take satisfactory photographs in ordinary daylight but not in dim light, because its aperture does not admit much light. The camera may produce a blurred picture if the subject is moving or is less than 6 feet (1.8 meters) away.

The presbyopic eye is also in a 'fixed-focus' state. This means that a presbyopic eye will see clearly only at a particular distance. If you correct the presbyopic eye for distance with glasses or contact lenses, then it will clearly see all the distant objects and may read 20/20 on the distance vision eye chart, but there is no way it would be able to clearly read up-close with the distance vision correction. On the other hand if you correct the eye for reading up-close, then you will be able to read clearly, but there is no way you will be able to see distance objects clearly with the same correction. So reading vision is at the cost of distance vision and vice versa. We hope that you grasp this important concept of the difficulty of simultaneously providing near and distance clear vision in a presbyopic eye. The only way one can get to this 'fountain of youth' is by restoring accommodation. All optical and most surgical options to manage presbyopia do not restore dynamic accommodation.

| Strategies for Presbyopia Management | |
|---|---|
| **Optical Correction** | |
| Eyeglasses | Reading Glasses<br>Bifocal or Trifocals<br>Progressives (no line bifocals) Review article |
| Contact Lenses | Contact Lens 'Monovision'<br>SofLens Multi-Focal<br>Acuvue Bifocal<br>Focus Progressives |
| **Surgical Correction** | |
| LASIK<br>(Laser vision correction) | Monovision with LASIK Publications: 1, 2.<br>Multifocal PRK or LASIK (experimental technique), Publications: 1, 2, 3 |
| Surgical Reversal of Presbyopia (SRP) | Scleral Expansion Bands, Publications: 1, 2. Contact Refocus Group<br>FDA Phase II clinical trials expected to begin in second half 2003<br>Anterior Ciliary Sclerotomy<br>Laser Reversal of Presbyopia. Contact: Surgilight. Press release: 1<br>FDA clinical trials underway |
| Intraocular Lens Implant (IOL)<br>(post cataract surgery) | Multifocal IOLs:<br>AMO Array (FDA approved) Refractive optics<br>Alcon MA60D3 AcrySof (Phase III clinical trials) Diffractive optics<br>Pharmacia (now Pfizer) 811E (clinical trials planned) Diffractive optics.<br>Accommodating IOLs:<br>CrystaLens<br>Akkommodative 1CU<br>SmartLens |

**If you see well at distance without glasses**, then all you would need are over-the counter reading glasses (sometimes called magnifiers) to help you read. These come in different powers (+1.00 to +3.50). An effective method to choose the right reading glass is the following: hold a newspaper or magazine at the distance at which you want to read. Then try different glasses and choose the reading glass that gives you clear vision - at the distance tested. This is an important point. While using this method, do not change your chosen distance for reading. If you do so, the reading glass power will have to be adjusted accordingly. A weaker glass (+1.00) will allow you to read further from your eyes, while a stronger glass (+2.50) will allow clear vision only when you get the reading material closer to your eyes. Both these glasses (weaker and stronger) are correct prescriptions, but only for the distance at which they allow clear vision. Depending on what you want to do, choose a weaker glass (for computer work) or a stronger glass (for reading a newspaper or magazine). You will not hurt your eyes with either glass. If you have the wrong power reading glass for the distance at which you want to read, then you will not be able to read comfortably. That does no harm your vision though.

Based on the results of a study we recommend that you wear your reading glasses only for reading and resist the temptation of keeping them always on your face, i.e. avoid looking at intermediate or distance objects through your reading glasses. Doing so can blur your distance vision over time (Ophthalmic Physiol Opt 2003 ;23:13-20).

It is not our intention to suggest that an eye care provider dispensed prescription reading glasses are unnecessary. The fact is that the vast majority of presbyopes will be satisfied with over-the-counter reading glasses. They do not cost a lot and therefore one can afford to keep multiple reading glasses (one for working on the computer & another one for reading up close) and there is less heartbreak when one breaks or loses them. If however, you are unhappy with your vision through these glasses or want bifocals/progressives, then you should get prescription glasses.

**If you do not see well at distance without glasses** (with one or both eyes) then you would need prescription reading glasses. This is invariably the case with nearsighted individuals (myopes) or those with astigmatism. Your eye care provider can determine the right glass for you. Your options are to either wear separate reading glass and distance glasses, which necessitates that you keep changing eyeglasses depending on what you are doing. Alternatively you can get bifocals or progressives. Bifocals were invented by Benjamin Franklin around 1760s (visit The Franklin Institute online). AgingEye Times will like you to remember some very important issues with bifocals. While wearing bifocals, you must not lean your head back while driving or look out the bottom part of the bifocal glasses while descending stairs. Doing so is a recipe for disaster. Indeed a recent study showed that older individuals who wore bifocals had a greater chance of falling due to tripping or while walking up or down stairs. The study estimated that about 35% of all falls in older people can be blamed on Bifocals/Progressive eyeglass use (J Am Geriatr Soc 2002;50:1760-6). This study recommended that older people should consider wearing non-multifocal glasses when negotiating stairs and in unfamiliar settings outside the home.

If a nearsighted individual removes the distance vision glasses, they are able to read. That is fine and does not harm the eyes. Depending on how high your nearsightedness is, you may have to hold objects very close to the eyes to read, closer than the comfortable reading distance of 14 inches.

There are surgeries that are being evaluated in FDA controlled clinical trials that claim to restore accommodation. We will await the results of **surgical reversal of presbyopia (SRP)** trials (see table above). In the meantime, the only options are some sort of a compromise. This means that we sacrifice a little clarity at both distance and near in favor of achieving 'functional vision' i.e. our ability to se at most distances (far and near) with acceptable but not-perfect clarity.

Several different strategies can be employed to achieve this goal. The most commonly used is **Monovision**. Herein the dominant eye is corrected for distance, and the non-dominant eye is not fully corrected, so that it enables some reading vision. If you cover one eye or the other, surely you will be able to tell the difference in image quality between the two eyes, however, if you resist the temptation to do so, then with both eyes open, the vision is good enough for most patients to function in most situations. Time magazine had reported that President Reagan used this strategy to give his speeches. Monovision cannot be achieved with eyeglasses. Monovision can be very effectively achieved with contact lenses. It does take some getting used to the visual compromises inherent in the monovision strategy. We recommend at least a 3 week trial with adequately prescribed monovision contact lenses before deciding whether you like this strategy or not. Studies have shown that one in four people will not like monovision. You will have to wear prescription glasses while performing activities that require fine vision, such as driving at night. Since depth perception may be reduced with monovision, it is a good idea to wear prescription glasses over your monovision contact lenses while driving.

Monovision can be achieved with **laser vision correction (LASIK)** too. A prerequisite for LASIK monovision is that you should accept monovision compromises. We recommend at least a 3 week trial period with monovision contact lenses and to proceed with LASIK monovision only if you are able to comfortably function with monovision strategy. Herein we would like to differentiate a commonly applied strategy in patients over forty who undergo LASIK. The surgeon usually under corrects one of the eyes. This under correction amount is much less that that required for monovision, and therefore some refer to this strategy as 'mini monovision'. The idea is to preserve some useful reading vision so that you are able to function in social situations - for example reading menu card in a restaurant.

Monovision can be achieved after cataract surgery as well. The power of the intraocular lens implant can be such that the dominant eye gets full correction for distance and the non-dominant eye has -1.0 diopter of nearsightedness.

Another option for patients undergoing cataract surgery is to have **multifocal intraocular lens** implants that are specially designed to allow for both distance and near vision. Again, there is visual compromise. Multifocal intraocular lens allows good 'functional vision' but not 'perfect vision' at both distance and near. A decrease in the contrast sensitivity function also occurs. A new breed of intraocular lenses are the so called '**accommodating intraocular lenses**'. These lenses are claimed to allow for dynamic accommodation and are under development or in early phases of clinical trials.

## The controversy surrounding 'Surgical Reversal of Presbyopia'

AgingEye Times believes that resolution of this controversial and somewhat contentious issue must await the results of the FDA sponsored clinical trials. There seem to be two issues. The first issue is the basis of these surgeries, i.e. the Schachar theory of accommodation. This theory runs counter to the almost universally accepted Helmholtz theory of accommodation. The second issue is the surgery itself. At present, based on experience of several surgeons, the surgical procedures seem not very effective with serious potential complications.

The **Schachar theory** suggests that the the ciliary muscle contracts during accommodation, placing more tension on the equatorial zonules while relaxing the anterior and posterior zonules. (In the Helmholtz theory all the zonules relax). This causes an increase in the equatorial diameter of the lens, decreasing the peripheral volume while increasing the central volume. As the central volume increases, so does the power of the lens. Under this theory, presbyopia occurs because of the increasing equatorial diameter of the aging lens. Once the lens diameter reaches a critical size, usually during the fifth decade of life, the resting tension on the zonules is significantly reduced. Thus, when the ciliary muscle contracts, insufficient tension is generated on the equatorial zonules to effect a change in central lens power, and accommodation is lost.

The Schachar theory has led to the development of two surgical approaches for the treatment of presbyopia, both attempting to achieve the same end result, which is to produce an outward stretching/bulging of the sclera. Anterior ciliary sclerotomy, involves making radial incisions in the sclera overlying the ciliary muscle. This may allow expansion of the sclera overlying the ciliary body, increasing the space between the lens equator and ciliary body. Another approach is to place PMMA segments in the sclera overlying the ciliary body.

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