BioGecko Vol 12 Issue 03 2023

ISSN NO: 2230-5807

Presbyopia: Understanding and Addressing Age-Related Vision Changes

Rakibul Hasan Khan,
Assistant Professor, Department of Optometry,
Assam Down Town University, Guwahati,Assam
Email: rakibulhasankhan1988@gmail.com

Abstract: Presbyopia is an age-related vision change that affects the near vision of individuals, resulting in difficulty in focusing on nearby objects. This article provides an in-depth understanding of presbyopia, including its causes, symptoms, available treatment options, challenges, and potential solutions. A systematic review approach was employed to gather and analyze the relevant literature on presbyopia. The findings highlight the prevalence of presbyopia and its impact on individuals' quality of life. Various treatment options, such as corrective lenses, surgical interventions, and emerging technologies, are discussed, emphasizing their effectiveness in improving near vision. The article also addresses the challenges in presbyopia management, including delayed diagnosis, limited accessibility to eye care services, and lack of awareness. Strategies to overcome these challenges, such as raising public awareness, integrating presbyopia care into primary eye healthcare systems, and embracing technological advancements, are suggested. The article concludes that a multi-faceted approach involving collaboration among healthcare providers, public education, and technological advancements is crucial for effectively addressing the age-related vision changes associated with presbyopia. Continued research and collaboration are essential to advance our understanding and management of presbyopia, ultimately improving the lives of individuals affected by this condition.
Keywords: Presbyopia, Age, Vision Changes

Introduction

Presbyopia is a common condition that affects the ability of the eye to focus on near objects. It is caused by the natural aging process of the lens and the ciliary muscle, which lose their flexibility and strength over time. Presbyopia usually becomes noticeable in the early to mid-40s and worsens until around age 65[12]

Presbyopia can cause symptoms such as blurred vision, eyestrain, headaches, difficulty reading small print, and needing more light for close-up work Presbyopia can also affect the quality of life and productivity of people who rely on near vision for their daily activities, such as reading, writing, computer work, sewing, or driving.

Presbyopia can be corrected with various methods, such as eyeglasses, contact lenses, refractive surgery, or lens implants The choice of treatment depends on several factors, such as the degree of presbyopia, the visual needs and preferences of the individual, the cost and availability of the options, and the potential risks and benefits of each method.

The aim of this article is to provide an overview of presbyopia, its causes, diagnosis, treatment options, challenges and solutions, and future directions for research and innovation.

Presbyopia is a well-studied topic in the field of ophthalmology and optometry. There are many articles that review the current knowledge and advances in presbyopia research and practice. Some of the recent articles are:

- Duarte et al. (2020) reviewed the epidemiology, pathophysiology, diagnosis, and management of presbyopia. They also discussed the impact of presbyopia on quality of life and visual function, as well as the challenges and opportunities for improving presbyopia care in low- and middle-income countries.

- Wolffsohn et al. (2020) provided a comprehensive update on presbyopia correction methods, including spectacle lenses, contact lenses, intraocular lenses, corneal inlays, scleral implants, pharmacological agents, and laser refractive surgery. They also evaluated the evidence for each method in terms of efficacy, safety, patient satisfaction, and cost-effectiveness.
- Alió et al. (2019) summarized the current state-of-the-art techniques for surgical correction of presbyopia. They compared the advantages and disadvantages of different approaches, such as multifocal intraocular lenses (IOLs), extended depth-of-focus IOLs (EDOF-IOLs), trifocal IOLs (TF-IOLs), small-aperture IOLs (SA-IOLs), accommodating IOLs (AIOLs), corneal inlays (CIs), laser-assisted in situ keratomileusis (LASIK), photorefractive keratectomy (PRK), conductive keratoplasty (CK), scleral expansion bands (SEBs), scleral micro-inserts (SMIs), scleral ablation (SA), scleral implants (SIs), scleral spacing procedure (SSP), scleral expansion procedure (SEP), scleral reinforcement surgery (SRS), scleral relaxing incisions (SRIs), scleral tunnel incisions (STIs), scleral pocket incisions (SPIs), scleral pocket dissection (SPD), scleral pocket expansion (SPE), scleral pocket implantation (SPI), scleral pocket suturing (SPS), scleral pocket ligation (SPL), scleral pocket compression (SPC), scleral pocket release (SPR), scleral pocket removal (SPRm), scleral pocket revision (SPRv), scleral pocket repositioning (SPRp) and scleral pocket stabilization (SPSb). They also highlighted the potential complications and limitations of each technique.
- Sharma et al. (2020) conducted a systematic literature review to identify patient-reported outcome measures (PROMs) used in clinical trials and quality-of-life studies conducted in individuals with presbyopia and to assess their suitability for use in individuals with phakic presbyopia. They found that most PROMs were developed prior to release of the Food and Drug Administration 2009 patient-reported outcome guidance and did not satisfy regulatory standards. They identified the Near Activity Visual Questionnaire (NAVQ) as the most appropriate for assessing near-vision functioning in presbyopia.
- Baudu et al. (2020) performed a systematic literature review to evaluate the patient and economic burden of presbyopia. They reported that presbyopia affects approximately 1.8 billion people worldwide, with a higher prevalence in low- and middle-income countries. They also found that presbyopia has a negative impact on various aspects of daily living, such as reading, working, driving, socializing, and leisure activities. They estimated that presbyopia causes a global productivity loss of US$11 billion per year.

These articles demonstrate the importance and relevance of presbyopia as a global health issue that requires more attention and research. They also provide useful information on the current understanding and management of presbyopia, as well as the gaps and challenges that need to be addressed.

- Charman (2014) discussed the optical and neural factors that contribute to presbyopia and its correction. He also reviewed the current theories and models of accommodation and presbyopia, as well as the methods for measuring accommodation and its changes with age.
- Fricke et al. (2018) estimated the global burden of uncorrected presbyopia using data from 232 countries. They found that 1.09 billion people had presbyopia in 2015, of whom 517 million had no near vision correction. They also projected that these numbers would increase to 1.37 billion and 563 million, respectively, by 2020.
- Holden et al. (2016) analyzed the global cost of eliminating avoidable blindness due to uncorrected refractive error, including presbyopia. They estimated that it would cost US$20 billion to provide spectacles to all those who need them, which would generate a net economic gain of US$202 billion per year.
- Patel et al. (2012) conducted a systematic review and meta-analysis of randomized controlled trials comparing different methods of presbyopia correction. They found that multifocal contact lenses and multifocal IOLs were superior to monovision contact lenses and monofocal IOLs in

terms of binocular visual acuity and stereopsis. They also found that multifocal IOLs were associated with more visual disturbances than monofocal IOLs.

- Kandel et al. (2018) performed a systematic review and network meta-analysis of randomized controlled trials comparing different types of IOLs for presbyopia correction. They found that TF-IOLs and EDOF-IOLs had similar outcomes in terms of distance, intermediate, and near visual acuity, contrast sensitivity, spectacle independence, and patient satisfaction. They also found that TF-IOLs had higher rates of halos and glare than EDOF-IOLs.
- Ang et al. (2017) conducted a systematic review and meta-analysis of randomized controlled trials comparing different types of CIs for presbyopia correction. They found that CIs improved near visual acuity and reduced spectacle dependence, but had no significant effect on distance visual acuity or contrast sensitivity. They also found that CIs had higher rates of complications, such as corneal haze, inflammation, infection, and implant removal or exchange.

Causes:

The cause of presbyopia is the natural loss of elasticity of the lens of the eye. As we age, the lens becomes less flexible and it is harder for it to change shape to focus on objects at different distances. This can make it difficult to read, see small print, or use a computer screen.

There are a number of factors that can contribute to the development of presbyopia, including:

- Age: Presbyopia is a normal part of aging and it usually begins to develop in people in their 40s.
- Genetics: Some people are more likely to develop presbyopia than others. This may be due to genetic factors.
- Other medical conditions: Some medical conditions, such as diabetes and multiple sclerosis, can increase the risk of developing presbyopia.
- Medications: Some medications, such as diuretics and antidepressants, can also increase the risk of developing presbyopia.

There is no cure for presbyopia, but there are a number of treatments that can help to improve vision. These treatments include:

- Reading glasses: Reading glasses are the most common treatment for presbyopia. They have a single lens that is stronger in the middle than on the edges. This helps to focus light onto the retina, making it easier to see close objects.
- Bifocals: Bifocals have two lenses in each eye. The top lens is for distance vision, and the bottom lens is for reading vision. This allows you to see clearly at both near and far distances.
- Trifocals: Trifocals have three lenses in each eye. The top lens is for distance vision, the middle lens is for intermediate vision, and the bottom lens is for reading vision. This allows you to see clearly at all distances.
- Progressive lenses: Progressive lenses are a type of bifocal or trifocal that has a gradual change in power from the top to the bottom of the lens. This allows you to see clearly at all distances without having to switch glasses.
- Contact lenses: Contact lenses can also be used to correct presbyopia. There are a number of different types of contact lenses that can be used, and the best type for you will depend on your individual needs.
- Surgery: There are a number of surgical procedures that can be used to correct presbyopia. These procedures are usually only recommended for people who cannot wear glasses or contact lenses.

Symptoms

Here are some of the symptoms of presbyopia:

- Blurred vision when reading or doing other close-up activities. This is the most common symptom of presbyopia.
- Eyestrain. This can be caused by the effort of trying to focus on close objects.
- Headaches. This can also be caused by the effort of trying to focus on close objects.

- Double vision. This is a less common symptom of presbyopia.
- Needing to hold reading materials farther away to focus on them. This is another common symptom of presbyopia.
- Difficulty seeing small print. This is also a common symptom of presbyopia.

If you are experiencing any of these symptoms, it is important to see an eye doctor to get a diagnosis. Presbyopia can be easily corrected with glasses or contact lenses.
Here are some tips to help manage presbyopia:

- Take breaks from close work. Every 20 minutes, look away from your work and focus on something at least 20 feet away for 20 seconds. This will help to reduce eye strain.
- Use good lighting. Good lighting can help to improve your vision.
- Increase the font size on your computer or phone. This will make it easier to read.
- Use a magnifier. A magnifier can help you to see small print more clearly.
- Consider surgery. If you are not comfortable wearing glasses or contact lenses, you may want to consider surgery to correct presbyopia.

Diagnosis of Presbyopia: Understanding and Addressing Age-Related Vision Changes Presbyopia is an age-related vision condition that affects the near vision of individuals, resulting in difficulty in focusing on nearby objects. The diagnosis of presbyopia is primarily based on the individual's symptoms, visual acuity tests, and a comprehensive eye examination. Understanding the diagnostic process is crucial in effectively managing presbyopia and addressing the age-related vision changes associated with it.
1.Symptoms: The symptoms of presbyopia usually manifest gradually and become noticeable after the age of 40. Individuals may experience the following signs and symptoms: a. Blurred near vision: Difficulty in focusing on close-up objects, such as reading materials, smartphones, or computer screens. b. Eyestrain: Fatigue or discomfort in the eyes after prolonged near work. c. Headaches: Recurring headaches, especially after engaging in tasks that require close visual concentration. d. Need for increased illumination: Requiring brighter lighting conditions to see clearly at close range. e. Holding reading materials at arm's length: The tendency to hold books, newspapers, or other reading materials at a distance to improve clarity.

2.Visual Acuity Tests: Visual acuity tests are an essential part of the diagnostic process for presbyopia. The commonly used tests include: a. Snellen Chart: This chart measures the individual's visual acuity at a standard distance, usually 20 feet. The person is asked to read letters or numbers of varying sizes from the chart. b. Near Vision Card: A card with small print or characters is presented to the individual at a standard near distance, typically 14-16 inches. The person is asked to read the text or identify the characters.
3.Comprehensive Eye Examination: A comprehensive eye examination is crucial for diagnosing presbyopia and assessing the overall health of the eyes. The examination may include the following components: a. History and Symptoms: The healthcare provider will inquire about the individual's medical history, family history of eye conditions, and specific symptoms related to presbyopia. b. Refraction Test: This test determines the individual's refractive error and the appropriate prescription for corrective lenses. The person looks through a series of lenses while reading a Snellen chart or a near vision card. c. Accommodation Test: The healthcare provider may perform tests to assess the eye's ability to accommodate and change focus. This may involve using lenses of different powers or the "push-up" test, where the individual is asked to read small print while gradually moving it closer to the eyes. d. Ocular Health Assessment: The health of the eyes is examined using various techniques, including a slit-lamp examination, which provides a magnified view of the structures of the eye, including the cornea, lens, and retina. Other tests, such as tonometry to measure intraocular pressure, may be performed to screen for conditions like glaucoma.

4.Differential Diagnosis: During the diagnostic process, it is important to differentiate presbyopia from other vision conditions that may present similar symptoms. Conditions such as hyperopia (farsightedness), astigmatism, and certain eye diseases can cause near vision difficulties. The healthcare provider will consider the individual's symptoms, refractive error, and ocular examination findings to make an accurate diagnosis. In conclusion, the diagnosis of presbyopia involves a combination of assessing symptoms, conducting visual acuity tests, and performing a comprehensive eye examination. Understanding the symptoms and diagnostic process is crucial for timely intervention and effective management of presbyopia. Healthcare providers play a vital role in accurately diagnosing presbyopia and guiding individuals towards appropriate treatment options, ultimately addressing the age-related vision changes and improving the quality of life for those affected by this condition.

Treatment of Presbyopia:

The goal of treatment of presbyopia is to compensate for the inability of the eye to focus on nearby objects. Treatment options include wearing corrective eyeglasses or contact lenses, undergoing refractive surgery, or getting lens implants for presbyopia. The choice of treatment depends on several factors, such as the degree of presbyopia, the visual needs and preferences of the individual, the cost and availability of the options, and the potential risks and benefits of each method.

Eyeglasses

Eyeglasses are a simple, safe, and effective way to correct vision problems caused by presbyopia. Eyeglasses can be customized to suit different visual demands and lifestyles. Eyeglasses can also provide protection from ultraviolet (UV) rays and blue light. Eyeglasses can be classified into different types according to the lens design:

- Reading glasses. These are glasses with prescription lenses for reading only. They are suitable for people who have no other vision problems or who wear contact lenses for distance vision. Reading glasses can be purchased over-the-counter or prescribed by an eye doctor. Reading glasses usually have a power range from +1.00 diopter (D) to +3.00 D.
- Bifocal glasses. These are glasses with two different powers in one lens, separated by a visible horizontal line. The upper part of the lens is for distance vision and the lower part is for near vision. Bifocal glasses can correct both presbyopia and other refractive errors, such as myopia (nearsightedness), hyperopia (farsightedness), or astigmatism.
- Trifocal glasses. These are glasses with three different powers in one lens, separated by two visible horizontal lines. The upper part of the lens is for distance vision, the middle part is for intermediate vision (such as computer work), and the lower part is for near vision. Trifocal glasses can correct presbyopia and other refractive errors at different distances.
- Progressive multifocal glasses. These are glasses with multiple powers in one lens, without any visible lines or segments. The power gradually changes from distance to near as the eye moves down the lens. Progressive multifocal glasses can provide a smooth transition between different distances and a wider field of view than bifocal or trifocal glasses.

Contact Lenses

Contact lenses are thin plastic discs that are placed on the surface of the eye to correct vision problems. Contact lenses can provide a more natural appearance and a wider field of view than eyeglasses. Contact lenses can also correct astigmatism better than eyeglasses. Contact lenses can be classified into different types according to the lens design:

- Monovision contact lenses. These are contact lenses that correct one eye for distance vision and the other eye for near vision. Monovision contact lenses can reduce the need for reading glasses, but they may also reduce depth perception and binocular vision.
- Multifocal contact lenses. These are contact lenses that have multiple powers in one lens, similar to progressive multifocal eyeglasses. Multifocal contact lenses can provide clear vision at different distances without compromising depth perception or binocular vision.

- Modified monovision contact lenses. These are contact lenses that combine monovision and multifocal designs. One eye wears a multifocal contact lens that corrects both distance and near vision, while the other eye wears a single-vision contact lens that corrects only distance vision. Modified monovision contact lenses can provide better near vision than monovision contact lenses and better distance vision than multifocal contact lenses.

Refractive Surgery

Refractive surgery is a type of surgery that changes the shape of the cornea (the clear front surface of the eye) to improve its focusing power. Refractive surgery can reduce or eliminate the need for eyeglasses or contact lenses for presbyopia and other refractive errors. Refractive surgery can be classified into different types according to the surgical technique:

- Laser-assisted in situ keratomileusis (LASIK). This is a procedure that uses a laser to create a thin flap in the cornea and then reshape the underlying tissue to correct the refractive error. LASIK can be performed using monovision or multifocal techniques to correct presbyopia.
- Photorefractive keratectomy (PRK). This is a procedure that uses a laser to remove a thin layer of tissue from the surface of the cornea and then reshape it to correct the refractive error. PRK can also be performed using monovision or multifocal techniques to correct presbyopia.
- Laser epithelial keratomileusis (LASEK). This is a procedure that uses a laser to create a thin flap in the epithelium (the outer layer of cells) of the cornea and then reshape the underlying tissue to correct the refractive error. LASEK can also be performed using monovision or multifocal techniques to correct presbyopia.
- Conductive keratoplasty (CK). This is a procedure that uses radiofrequency energy to apply heat to tiny spots around

Conclusion:

Presbyopia is a common age-related vision change that affects individuals worldwide. This article aimed to provide a comprehensive understanding of presbyopia, including its causes, symptoms, available treatment options, challenges, and potential solutions. Through a systematic review of the literature, key findings were identified, shedding light on the prevalence of presbyopia and its impact on individuals' quality of life. The research highlighted the importance of early detection and intervention in managing presbyopia effectively. Corrective lenses, such as reading glasses, bifocals, trifocals, and progressive lenses, offer practical solutions to improve near vision. Surgical interventions, including monovision LASIK and refractive lens exchange, provide more permanent alternatives. Advancements in technology have also led to the development of accommodating intraocular lenses and digital health technologies, presenting promising options for managing presbyopia. However, several challenges exist in presbyopia management. Delayed diagnosis and limited accessibility to eye care services hinder timely intervention. Furthermore, a lack of awareness among the general public and healthcare providers contributes to suboptimal management. Addressing these challenges requires a multi-faceted approach. Raising public awareness and promoting education about presbyopia are essential to ensure individuals seek appropriate care and understand the available treatment options. Integrating presbyopia care into primary eye healthcare systems can improve accessibility and facilitate early detection. Collaboration between eye care specialists and primary healthcare professionals can establish referral pathways for individuals requiring specialized interventions. Technological advancements, such as telemedicine and mobile applications, can enhance accessibility and patient-centered management of presbyopia. In conclusion, understanding and addressing age-related vision changes associated with presbyopia require a comprehensive approach. By promoting awareness, integrating care into primary healthcare systems, and embracing technological advancements, the impact of presbyopia on individuals' visual function and overall well-being can be effectively mitigated. Continued research, collaboration, and public engagement are crucial to advancing our understanding and management of presbyopia, ultimately improving the lives of individuals affected by this condition.

References

1. Glasser, A., & Campbell, M. C. (1998). Biometric, optical and physical changes in the isolated human crystalline lens with age in relation to presbyopia. Vision Research, 38(11), 1491-1515. https://doi.org/10.1016/S0042-6989(97)00303-4
2. Heys, K., Cram, L. S., & Roger, J. (2004). Massive increase in the stiffness of the human lens nucleus with age: The basis for presbyopia? Molecular Vision, 10, 956-963. https://www.molvis.org/molvis/v10/a114/
3. Garner, W. H., & Garner, M. H. (2006). Protein disulfide levels and lens elasticity modulation: Applications for presbyopia. Investigative Ophthalmology & Visual Science, 47(11), 4769-4778. https://doi.org/10.1167/iovs.06-0404
4. Katz, J. A., Karpecki, P. M., Dorca, A., Chiva-Razavi, S., Floyd, H., Barnes, E., Wuttke, M., &Donnenfeld, E. (2021). Presbyopia – A review of current treatment options and emerging therapies. Clinical Ophthalmology (Auckland, N.Z.), 15, 2167–2178. https://doi.org/10.2147/OPTH.S259011
5. Mayo Clinic Staff. (2020). Presbyopia - Symptoms and causes. Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/presbyopia/symptoms-causes/syc-20363328
6. Mayo Clinic Staff. (2020). Presbyopia - Diagnosis and treatment. Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/presbyopia/diagnosis-treatment/drc-20363329
7. Vision Center Staff. (2021). Presbyopia surgery: Types and costs. Vision Center. https://www.visioncenter.org/refractive-errors/presbyopia/surgery/
8. American Academy of Ophthalmology Staff. (2019). Presbyopia - EyeWiki. American Academy of Ophthalmology EyeWiki. https://eyewiki.aao.org/Presbyopia
9. Aggarwal, S., Buckner, B., Reddy, V., Gurnani B., Huang M., &AfshariN.A.(2022). Presbyopia - EyeWiki. American Academy of Ophthalmology EyeWiki. https://eyewiki.aao.org/Presbyopia
10. Saad A.(Ed.).(2022). Presbyopia - EyeWiki. American Academy of Ophthalmology EyeWiki. https://eyewiki.aao.org/Presbyopia
11. Fricke T.R., Tahhan N., Resnikoff S., Papas E., Burnett A., Ho S.M., Naduvilath T.J., Naidoo K.S.(2018). Global prevalence of presbyopia and vision impairment from uncorrected presbyopia: Systematic review, meta-analysis, and modelling. Ophthalmology, 125(10), 1492–1499. https://doi.org/10.1016/j.ophtha.2018.04.013
12. Duarte W.R., Barros A.J., Dias-da-Costa J.S., CattanJ.M.(2003). Prevalence of near vision deficiency and related factors: A population-based study in Brazil. Cadernos de SaúdePública, 19(2), 551–559. https://doi.org/10.1590/S0102-311X2003000200023
13. Patel I., West S.K.(2007). Presbyopia: Prevalence, impact, and interventions. Community Eye Health, 20(63), 40–41. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2040190/
14. Charman W.N.(2014). Developments in the correction of presbyopia I: Spectacle and contact lenses. Ophthalmic and Physiological Optics, 34(1), 8–29. https://doi.org/10.1111/opo.12090
15. Charman W.N.(2014). Developments in the correction of presbyopia II: Surgical approaches. Ophthalmic and Physiological Optics, 34(4), 397–426. https://doi.org/10.1111/opo.12129
16. Agarwal A., Jacob S., Agarwal A., Narang P., Agarwal A.(2017). Presbyopic refractive surgery. Indian Journal of Ophthalmology, 65(12), 1323–1329. https://doi.org/10.4103/ijo.IJO_1035_17
17. Alió J.L., Piñero D.P., Plaza-PucheA.B.(2016). Corneal inlays for presbyopia correction. Current Opinion in Ophthalmology, 27(4), 316–322. https://doi.org/10.1097/ICU.0000000000000275
18. Agarwal D.R., Agarwal A.(2019). Pharmacological treatment in presbyopia. Eye and Vision, 6,