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Unifocal vs bifocal vs progressive glasses: Which one to choose?

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Abstract
The chief question that arises when choosing near and distance glasses is to which one to select. There is a major bunch of people who usually buy glasses due to recommendations or suggestions from peers without having adequate knowledge about them, and end up having asthenopic and adjustment issues. The main aim of this study is to give a basic idea of unifocal, bifocal glasses and progressive glasses, to compare their pros and cons and patient suitability according to various factors. While prescribing glasses there is no one-size-fits-all kind of solution. So this study gives an idea how a qualified person should give options wisely that is the best for them.

Keywords: Presbyopia, bifocal lens, progressive glass, accommodation, image jumping, intermediate vision, distant vision, near vision

Introduction
The optical system of the eye boosts its focusing strength when someone switches from a distant to a close-up fixation point. This helps the eye to clearly focus the object's picture on the retina. This capacity is called accommodation, and the highest level of accommodation a person is capable of exhibiting is referred to as amplitude of accommodation.[1]
Presbyopia, from the Greek words presy, which means "old," and opia, which means "eye," refers to the age-related decrease in accommodation amplitude, which makes it difficult to maintain clear and comfortable vision at the usual near working distance. It is a condition where the eye's accommodating capacity, brought on by ageing, is insufficient for close work. Presbyopia occurs when a patient's amplitude of accommodation is insufficient to allow for clear vision at a typical working distance [1, 2].
The lens's size and shape, the lens capsule's loss of flexibility, the gradually changed anterior segment geometry, the lens' increasing thickness, and the zonular fibres and ciliary muscles surrounding the lens all contribute to the decline in accommodative ability (AA) as people age. The lens becomes harder as we age, and the ciliary muscle becomes less active [2].
Presbyopia manifests around the age of 40 to 45 years. The initiation of presbyopia depends on a number of different factors such as refractive errors, geographical distribution, profession and some other factors such as illumination conditions and ambient temperature.[3]
Reading spectacle or plus lenses are prescribed for presbyopia to reduce the near stimulus to accommodation [4]. The additional power increases with increasing age as the AA declines.[1]
Whenever we give plus lenses to presbyopes there is a change in AA.
There are now five different types of spectacle lenses that can be used to treat presbyopia: single vision, bifocal, trifocal, occupational quadrifocals, and multifocal/progressive addition lenses. Choosing the appropriate sort of corrective modality is crucial when prescribing from the many possibilities available.

Discussion
Among the spectacle correction, we have three main options available.

Single Vision Glasses: Single vision lenses are the original and most popular solution for vision correction. The unifocal glasses, also known as single vision glasses, have a power correction that is consistent across the whole lens. Distance and close-up vision lenses are created separately for single vision glasses. Therefore, a person must typically handle two glasses at once, which is a challenging chore in and of itself.

One benefit of single vision eyewear is that it is more affordable than alternative methods of managing presbyopia in situations of anisometropia, aniseikonia, or isotropic keratosis with significant refractive error.

Bifocal Glasses: Bifocal lenses are the second option for correcting presbyopia using eyeglasses. The little extra window of glass known as a bifocal enables the patient to adjust for reading. One lens type is used in the upper portion of bifocal glasses to correct for distance vision, and the other lens type is used in the lower portion to correct for near vision. The near correction is distinguished from the distance correction by a clear semicircular line that is visible in bifocal glasses. (Fig. 1a). These are the most commonly prescribed glasses seen in India. Depending upon the types of bifocal segment these are available as Round top/ Kryptop, D-Segment, Flat top, Panoptic, Executive bifocals, B-segment or R-segment bifocals [5].

Their size and locations of segments are quantified by means of a few standardized terms. The size of a segment horizontally, or segment width, is measured across the widest section of the segment area (Fig. 1b). Segment depth is the segment's longest vertical dimension. Segment height is measured vertically from the lowest point on the lens to the level of the top of the segment, depending on the frame for which the lenses have been designed. Segment drop is the vertical separation between the top of the segment and the main reference point (MRP) of the lens. To match to the wearer's interpupillary distance, the distance component of the lens has to be offset from the geometric centre of the lens opening of the frame (PD). Inset or outset are terms used to describe this. To correlate to the nearby PD, the portion has to be further decentered. Segment inset is the name for this segment decentration [6].

Near segment has the net power resulting from the combination of the distance power and the add power is termed the near power, or near prescription. One-piece glass bifocals are usually either the full-segment Franklin-style lens with the near portion in the lower portion of the lens [5].

Optics

The optics of the bifocal segment is similar to those of any other lens. The upper portion corrects for distance and the segment has near correction (Fig. 1c). The segment has a refractive power (the "add") and an optical center, such that prismatic effects due to the segment [6].

Image Jump is produced by the sudden introduction of the prismatic power at the top of a bifocal segment. The object the individual sees in the inferior field suddenly jumps upward when the eye turns down to look at it. If the optical center is at the top of the segment, there is no image jump. Image jump is worse in glasses with a round top bifocal, because the optical center of the bifocal is farther from the distance lens optical center. A flat top bifocal is better because the optical center of the bifocal is close to the distance optical center [5].

The shape of the bifocal segment is chosen according to the ocular condition, prescription and occupation. Bifocal lenses are best for presbyopes who want multiple visual corrections at an affordable price.

Advantages

- Lens corrects for two different focal points. It can be made for distance-near points, intermediate-near points or even distance-intermediate points.
- It renders a solution for viewing at two different distances in a very cost-effective way.
- Very convenient to use, as a lesser adaptability problem unlike progressive lenses.
- Any type of frame can be used to mount bifocal glasses.

Disadvantages

- Prime discomfort is a sudden jump of image when changing the view from far to close.
- A discrete line over these glasses due to near addition gives them an odd look so young presbyopes hesitate to use them.
- On near focusing, image displacement occurs due to prismatic effect. The image quality also gets compromised due to this effect.
- Lack of an intermediate zone makes these glasses unfavorable for computer users.
- Headache and dizziness occur in some users.

Progressive Glasses: The third option here is progressive glasses. These are seamless multifocal glasses in which there is no distinctive line of separation for distance, intermediate or near prescription. The need for these glasses is increased when someone is working in a setup where intermediate work is more. In progressive glasses, as the name implies, the power correction for multiple distances in a progressive way, that is, for distant in the upper part, for near at the bottom and intermediate view in between. It provides the user with a wide spectrum of the visual field which is a limitation in bifocal glasses. Progressive glasses are best for users who want a seamless visual correction for distance, near and everything in between [5].

Optics

Progressive addition lenses are made with the help of specially designed front surface curves. These changing surface curves cause the lens to gradually increase in plus power, beginning in the distance portion and ending in the near portion. progressive addition lenses are sometimes referred to as invisible bifocals. However, invisible bifocals have round segments where the demarcation line between the distance portion and the bifocal segment has been polished out, causing the two areas to appear as if blended together. Invisible bifocals are really blended bifocals, not progressive addition lenses [5].

The need for these glasses is increased when someone is working in a setup where intermediate work is more. In progressive glasses, as the name implies, the power correction for multiple distances in a progressive way, that is, for distant in the upper part, for near at the bottom and intermediate view in between (Fig. 2). It provides the user with a wide spectrum of the visual field which is a limitation in bifocal glasses. Progressive glasses are best for users who want a seamless visual correction for distance, near and everything in between [5].

The distance power arc indicates the recommended position of the lens through which the distance power should be read on the lensmeter. The distance reference point (DRP) is at the center of the arc (Fig. 3a). The fitting cross will normally be centered in the pupil. The two horizontal dashes to the left and right sides of the lens help to tell if the lens is level or tilted. The centrally located PRP dot is used to verify prism power. This is the same as the MRP. The circle

in the lower part of the lens locates the near reference point (NRP) and is used to verify near power.

All general-purpose PALs have optical characteristics created on the front lens surface: A distance area that is defined by a stable distance power in the upper portion of the lens; a near area with the stable spherical near prescription inset into the lower part of the lens; an intermediate zone or channel (the progressive corridor, the center line of which is the umbilicus), which contains a continuous increase in plus spherical refractive power from the distance power to the near power; and the periphery, where unwanted astigmatism and prismatic distortion are induced by the front surface curvatures necessary to produce the spherical non distorted areas (distance, near, and intermediate) on the front surface (Fig. 3b) [6].

Advantages

- They give multiple rectifications all over the glass to provide uninterrupted vision at all points from distance to near.
- Most useful in occupations where vision frequently changes from far to intermediate to near vision.
- No need to carry multiple glass pairs for distance, intermediate and near view.
- Gives a seamless attractive look so the first preference of young presbyopes.

Disadvantages

- Peripheral vision in the lower area gets blurred on either side because of the corridor in this lens. More aberrations at the periphery.
- Due to the distortion effect, frequent nausea, dizziness and motion sickness is very common. Need more horizontal head movement to view the periphery.
- Person has to train himself to adjust to these glasses and it may take weeks, months or sometimes even years.
- Fitting is an important concern for making these lenses as the pupillary center of the user should be kept in mind for the reference position.
- Comparatively expensive, so unaffordable to many.

The study by Jeewanand Bist[7] suggested that nearly half reported that non-tolerance (47.4%) was due to an error in refraction. Other causes identified were errors related to communication (16.3%), dispensing (13.5%), non-adaptation (9.7%), data entry (8.7%), binocular vision (7.4%) and ocular pathology (6.4%). non-tolerance may lead to spectacle wear discontinuation, which may deprive patients of optimal vision. Increased non-tolerance in clinical practice may affect a clinician's reputation and incur additional costs associated with reassessments and replacements [7].

The study by Matthew A. Timmis *et al.* [8] concluded that use of single-vision distance spectacles led to improvements in landing control, consistent with individuals being more certain regarding the precise height of the lower floor level. This enhanced control was attributed to having a view of the foot, step edge, and immediate floor area that was not blurred, magnified, or doubled and that did not suffer from image jump or peripheral distortions.

These findings provide further evidence that use of single-vision distance lenses in everyday locomotion may be advantageous for elderly multifocal wearers who have a high risk of falling [8].

Srinivas Marmamula et al. [9] suggested that a large unmet need and spectacle correction coverage could be improved by the provision of good quality, affordable spectacles, which may also improve spectacles use among the presbyopes [9].

Heidi R. Laviers et al. [10] highlighted the value of correcting presbyopia from the community perspective and the necessity of providing affordable, quality, and accessible near spectacles at the primary health level [10].

Tips of getting adjustment for bifocal wearers

1. Try putting on new glasses first in the morning and wear them for just an hour or two. The next morning, try a few more hours. Slowly build up your tolerance to adjust to them.
2. Don't switch between your new pair and your old one.
3. Make sure your eyeglasses fit properly and don't slide down your nose.
4. When you walk; look straight ahead, not down at your feet. Also work on pointing your nose in the direction you want to look, not just looking left or right with your eyes.
5. While reading, hold items down and about 16 inches away from the eyes. Look through the bottom of your lenses.
6. Don't move eyes or head as you read. Move the page or paper instead.
7. Set your computer screen just below eye level. You can adjust your desk or chair to make this happen.

Tips of getting adjustment for progressive lenses

1. Be patient, the adjustment period for progressive glasses varies from days to months.
2. Always choose a perfect fitting frame because centration of lens is very important for perfect vision and easier adaptation.
3. Face angle and interpupillary distance measurements should be accurate to avoid prismatic effect.
4. Shorter vertex distance and accurate pantoscopic tilt to be chosen for better field of view and reduce aberrations.
5. Choose frame height according to fitting height and corridor length according to the type of progressive lens design chosen.
6. Avoid using too small or aviator style frames, it may hamper near vision.
7. Use your glasses as frequently as possible to make adaptation quick.

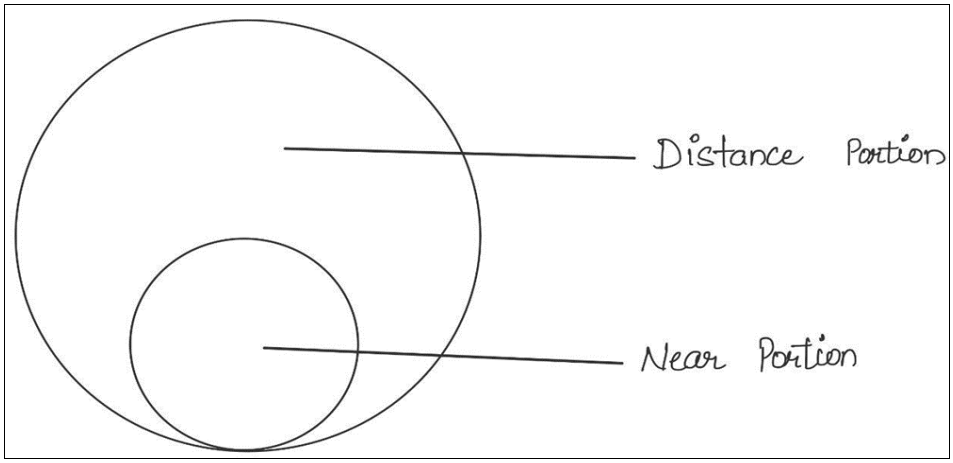

Fig 1a: Parts of bifocal glass

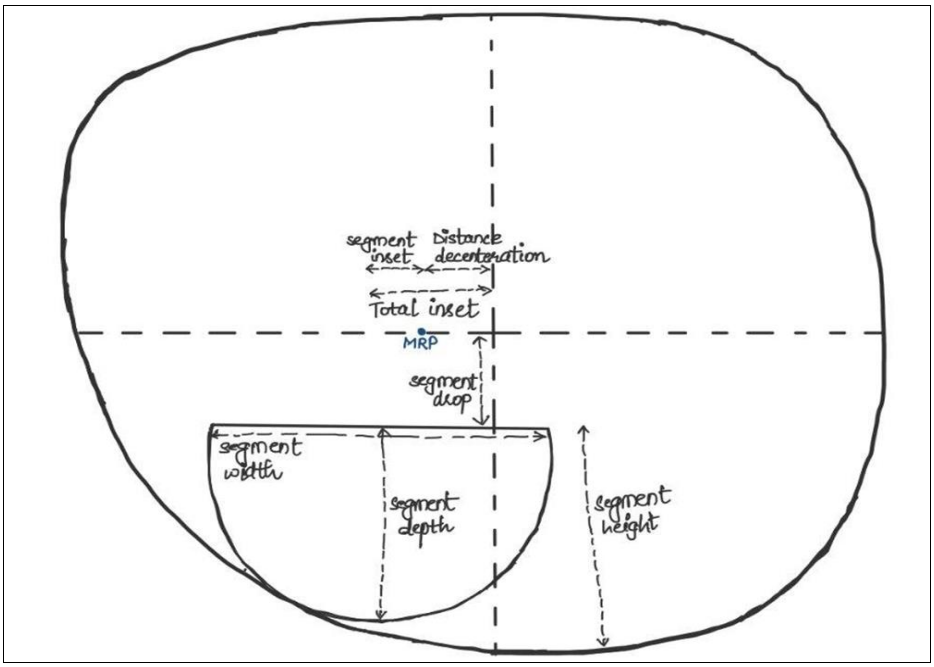

Fig 1b: Various segments of bifocal lens

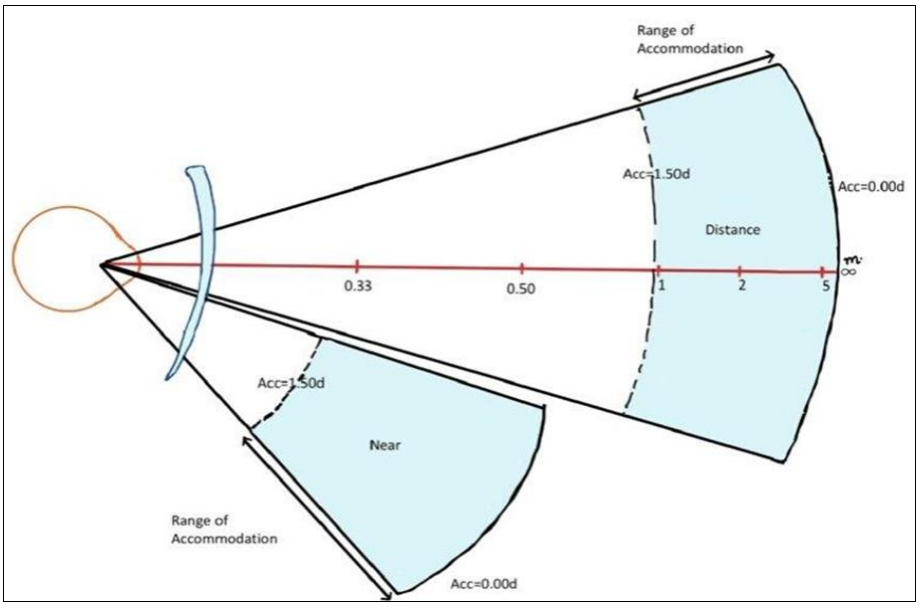

Fig 1c: Optics of bifocal lens

Fig 1: Shows parts of a bifocal glass (fig. 1a) and various segments of a bifocal lens (fig. 1b). The lower image explains the optics of image formation in a bifocal lens (fig. 1c).

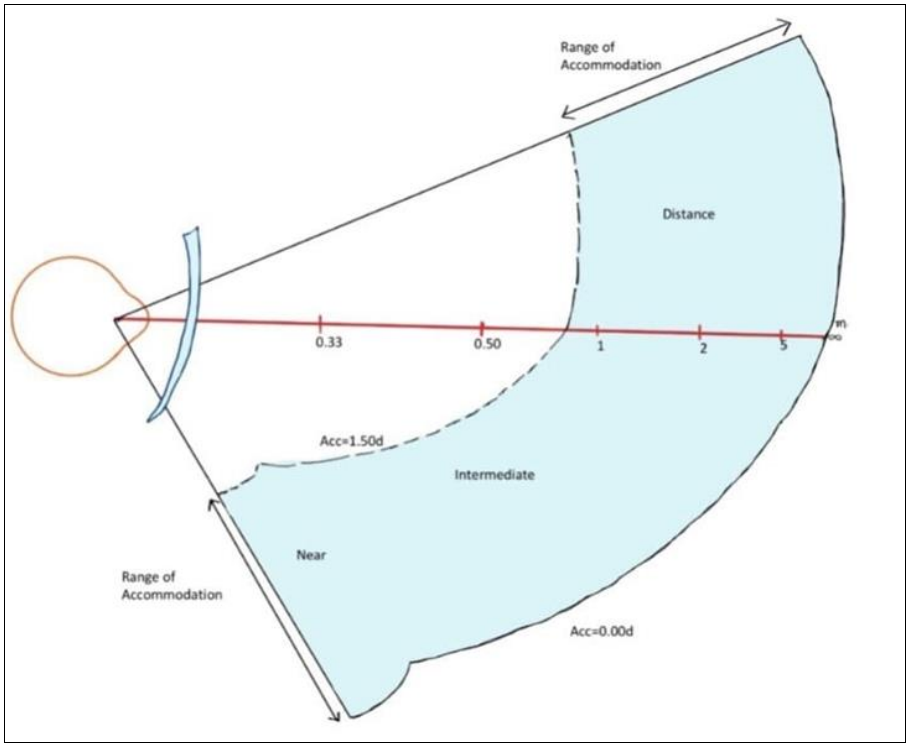

Fig 2: Shows optical aspect of progressive lens image formation.

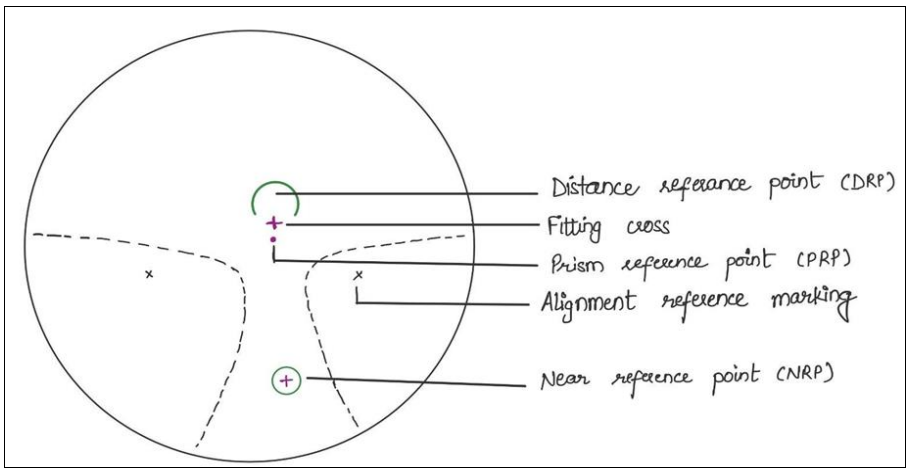

Fig 3a: Reference points of progressive lens

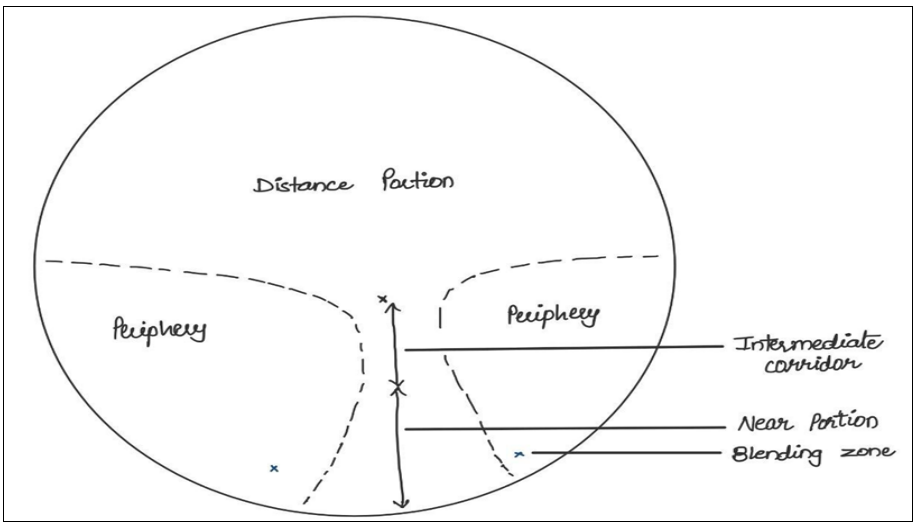

Fig 3b: Parts of progressive glass

Fig 3: Shows different verification points of a progressive lens (fig. 3a) and various parts of a progressive glass (fig. 3b).

Conclusion

All the lenses available in the market have their pros and cons. The most important aspect is to choose according to the patient profile. Age, professional need, compliance of patient, lifestyle aspects and cost effectiveness need to be considered while selecting these glasses.

Author's Contribution

Not available

Financial Support

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