Original Article/นิพนธ์ต้นฉบับ

การประเมินรูปแบบการใช้เลนส์สัมผัสหลายระยะที่มีจำหน่ายในประเทศไทย

วิชัย ลีละวงค์เทวัญ, พ.บ.

บทคัดย่อ

วัตถุประสงค์: เพื่อประเมินรูปแบบการใช้เลนส์สัมผัสหลายระยะที่มีจำหน่ายในประเทศไทยในผู้ที่มีสายตายาวสูงอายุ

วิธีการวิจัย: เป็นการศึกษาแบบไปข้างหน้าจากผู้ที่มีสายตายาวสูงอายุจำนวน 60 คน ที่มีค่าสายตาเอียงไม่เกิน 0.75 ไดออพเตอร์ และไม่มีโรคตาใดๆ และยินดีที่จะเข้าร่วมโครงการ โดยได้รับการตรวจสายตาที่ระยะไกล ใกล้ และการรับภาพสามมิติ รวมทั้งการตรวจหาตาหลักและตารอง ผู้เข้าร่วมโครงการได้รับการแก้ไขสายตาด้วยเลนส์สัมผัสหลายระยะชนิดนิ่มแบบเปลี่ยนรายเดือน (Frequency® 55 Multifocal) โดย D lens เน้นดูไกลจะใส่ในตาหลักและ N lens เน้นดูใกล้จะใส่ในตารอง ผู้เข้าร่วมโครงการถูกแบ่งเป็น 3 กลุ่ม (กลุ่มละ 20 คน) โดยใช้สายตามองไกลเป็นเกณฑ์คือ กลุ่มที่ 1 สายตาสั้นให้ใส่เลนส์แบบ D lens + N lens และแบบ D lens + D lens กลุ่มที่ 2 สายตายาวให้ใส่เลนส์แบบ D lens + N lens แบบ D lens + D lens และแบบ N lens + N lens กลุ่มที่ 3 สายตาปกติให้ใส่เลนส์แบบ D lens + N lens แบบ N lens + N lens และแบบ N lens ข้างเดียว โดยใส่แต่ละแบบนาน 1-2 สัปดาห์ จากนั้นเทียบค่าสายตาโดยรวมทั้งสองข้างในแต่ละแบบโดยใช้ค่าสายตาที่ดีที่สุดของการใส่แว่นเป็นเกณฑ์

ผลการวิจัย: กลุ่มที่ 1 พบว่ามีเพียงการมองระยะใกล้ที่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ ($p<0.05$) โดยการใส่แบบ D lens + N lens ดีกว่าแบบ D lens + D lens กลุ่มที่ 2 พบว่าการมองระยะไกลและใกล้มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ ($p<0.05$) โดยการมองระยะไกลการใส่แบบ N lens + N lens ด้อยที่สุด ในขณะที่การมองระยะใกล้การใส่แบบ D lens + D lens ด้อยที่สุด กลุ่มที่ 3 พบว่ามีเพียงการมองระยะไกลที่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ ($p<0.05$) โดยการใส่แบบ N lens ข้างเดียวดีที่สุดแต่การใส่แบบ N lens + N lens ด้อยที่สุด ไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติของการรับภาพสามมิติในแต่ละแบบของทุกกลุ่ม แต่การรับภาพสามมิติในทุกแบบลดลงจากเดิมร้อยละ 59.38

สรุปผลการวิจัย: โดยการใช้สายตามองไกลเป็นเกณฑ์ กลุ่มสายตาสั้นและสายตายาวควรใส่เลนส์แบบ D lens + N lens กลุ่มสายตาปกติควรใส่เลนส์แบบ N lens ข้างเดียว **จักษุเวชสาร 2553; กรกฎาคม-ธันวาคม 24(2): 86-94.**

ภาควิชาจักษุวิทยา คณะแพทยศาสตร์ มหาวิทยาลัยธรรมศาสตร์ศูนย์รังสิต ปทุมธานี 12120

ข้อพิจารณาด้านจริยธรรม: การวิจัยนี้ได้ผ่านการอนุมัติด้านจริยธรรมการทำวิจัยในคนโดยคณะอนุกรรมการจริยธรรมการวิจัยในคนชุดที่ 1 มหาวิทยาลัยธรรมศาสตร์ ตามมติที่ประชุมครั้งที่ 9/2550 เมื่อวันที่ 2 ตุลาคม 2550

Original Article/นิพนธ์ต้นฉบับ

The Pattern Assessment of Wearing Multifocal Contact Lenses in Thailand

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Abstract

Objective: A study was conducted to evaluate multifocal contact lens patterns available in Thailand in presbyopes.

Materials and Methods: A prospective study was conducted on sixty healthy eye presbyopes who had astigmatism ≤ 0.75 diopter, and who had given consent to participate in the trial. The subjects were evaluated on their distance and near vision, stereopsis, and for dominant and non-dominant eyes. Monthly replacement soft multifocal contact lenses (Frequency® 55 Multifocal) available in Thailand were introduced to the subjects; the distance lens (D lens) was applied to the dominant eye and the near lens (N lens) was applied to the non-dominant eye. The subjects were categorized into 3 groups (20 subjects each) based on distance vision: group 1 were myopic presbyopes and applied D lens + N lens, and D lens + D lens; group 2 were hyperopes and applied D lens + N lens, D lens + D lens, and N lens + N lens, and group 3 were emmetropes and applied D lens + N lens, N lens + N lens, and only N lens. They were assigned to use the lenses 1 to 2 weeks for each pattern. Their vision was compared among each pattern based on best corrected vision.

Results: Group 1 revealed statistical significance only in the near vision ($p<0.05$), in which the pattern D lens + N lens was better than D lens + D lens. Group 2 showed data for both the distance and near visions were statistically significant ($p<0.05$), for the distance vision the N lens + N lens was the worst pattern, while the D lens + D lens was the worst pattern for the near vision. Group 3 indicated statistical significance only in the distance vision ($p<0.05$), for which using only N lens was the best pattern, while the N lens + N lens was the worst pattern. Stereopsis indicated no statistical significance for any pattern in all groups. However, stereopsis decreased from the best corrected vision by 59.38%.

Discussion: Myopic and hyperopic presbyopes should apply the D lens + N lens, while emmetropic presbyopes should apply only N lens. **Thai J Ophthalmol 2010; July-December 24(2): 86-94.**

Keywords: multifocal contact lens, presbyopia, dominant eye, non-dominant eye

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Ethics: This study was approved for ethical research in humans by the ethics subcommittee for research in humans series 1, Thammasat University, by resolution in the meeting 9/2007 held on October 2, 2007.

Introduction

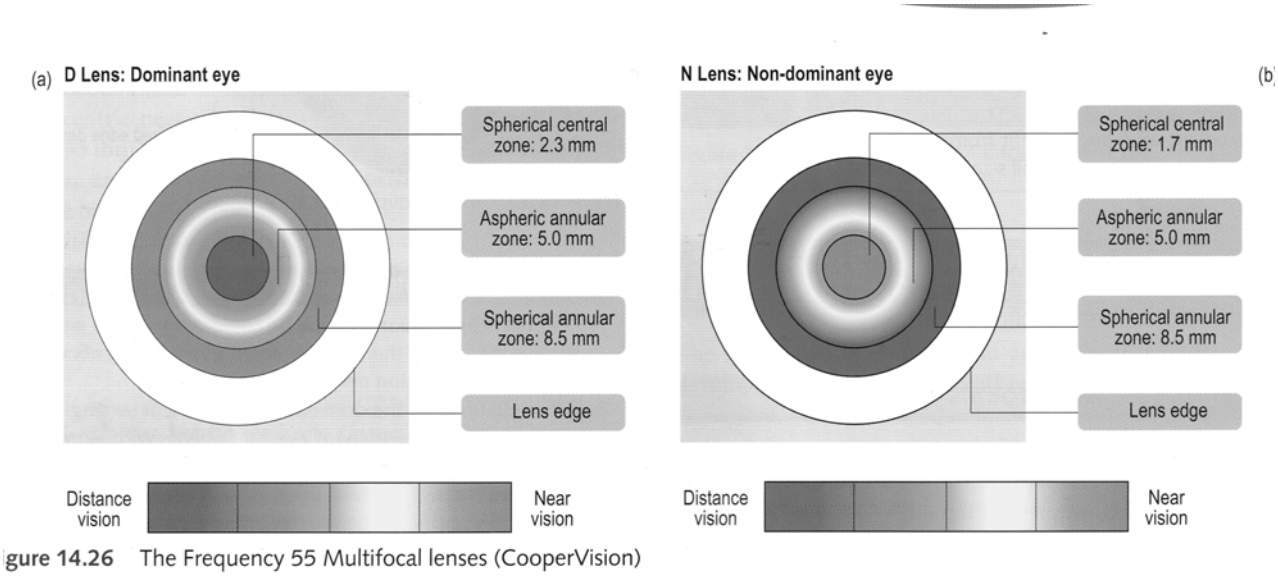
Presbyopia is defined as the progressive deterioration of the eye's ability to see near objects. Causes include the lens becoming more stiff and hence losing its ability to adjust its thickness to viewing objects at different distances, along with the ciliary muscles losing strength and, hence, the ability to adjust the curvature of the lens[1]. The common solutions to presbyopia are wearing eyeglasses, undergoing near vision conductive keratoplasty using radiofrequency[2], and wearing contact lenses. There are many ways for presbyopes to utilize contact lenses to correct their visions. One way is to wear distance contact lenses to see objects far way with near eyeglasses on top to view objects nearby. This is a good option allowing presbyopes to see both near and far, but still requires the use of eyeglasses. Another way, called monovision, is to wear a distance contact lens on one eye and a near one on the other. This allows presbyopes to buy regular contact lenses which are cheaper. The user will also have fewer visual problems associated with the pupil size, and can also consider it a viable solution or not once he or she tries it[3,4]. However, there are a few disadvantages to applying monovision which include stereopsis, which lessens the user's ability to drive, and may cause visual stress[5]. The third way to use contact lenses is using bifocal or multifocal contact lenses, of which there are two types including rigid gas permeable lenses and soft hydrogel lenses. There are two main designs of this type[6]. One type is the simultaneous vision or bivision design, which is designed to apply multiple powers in front of the pupil. This type of design is available in both rigid gas permeable lenses and the soft hydrogel lenses. This design can also be divided into three sub-types including aspheric, concentric, and diffractive types. Aspheric lenses are adjusted at the curvature to enable different powers at different points on the lens. Concentric lenses are added with various sizes of strips surrounded by rings. Diffractive lenses rely on diffraction whereby rifts called Eschelettes are created at the back of the lens, which will diffract light at different angles, giving the lens multiple powers[7]. The second type of design is the translating or alternating design, which allows the lens to move freely to adjust to viewing far or near objects. This type of design allows only one power to be put in front of the pupil at each viewing and hence is typically made in the form of rigid gas permeable lenses. These lenses are designed to have segments, much like bifocal eyeglasses, which rely on moving the lens upwards to see near objects, and downwards to see far objects. Another design for this type of lenses is concentric design on which the middle is used to view far objects, and has larger strips than the concentric simultaneous vision.

It is predicted that in the next 10 to 20 years contact lens use will increase as the aging population grows considerably[8]. A considerable number of people in this particular group have never worn eyeglasses, and are opposed to the idea, while activities requiring near vision increase in their lives. Fisher et al. reported that contact lenses are better than eye glasses because contact lenses require less head movement, as eye movement is used to adjust to viewing objects at various distances, and that eyeglasses have particular spots through which seeing an object is less clear[9]. While there are many obvious advantages to using multifocal contact lenses, their popularity remains low, either because ophthalmologists find them a complicated treatment for patients, that patients are unaware of this type of contact lenses, or that this type of contact lenses was not introduced as a viable choice of treatment[6].

At present, Thailand imports very few types of

contact lenses for presbyopes, including monthly soft multifocal lenses, and simultaneous vision contact lenses in the spheric and aspheric designs. These lenses are used with the concept of modified monovision, which requires the use of two different types of lenses at the same time. One type is the D lens or distance lens, which includes a 2.3 mm spheric ring with the power to view far objects, outer 5 mm aspheric ring, and 8.5 mm spheric ring, whereby the lens will increase in focal power for viewing near objects. The other type is the N lens or near lens, which includes a 1.7 mm spheric ring in the middle used to view near objects, a 5 mm aspheric ring, and an 8.5 mm spheric ring, whereby the lens will decrease in focal power for viewing far objects6 (Figure 1.). The general characteristics of this type of lens are a diameter of 14.4 mm, a curvature of 8.7 mm, made of 45 % methafilcon A and 55% water, produced via a cast-mold system, with oxygen permeability (DK/L) $15x10^{-9}$, a +4.00 to -6.00 diopter focal power to view far objects, and an increased 4-level focal power to view near objects of +1.00, +1.50, +2.00, and +2.5 diopters. Its trade name is Frequency® 55 Multifocal produced by CooperVision Limited. These lenses are approved by the Food and Drug Administration of the United States of America and Thailand as well. The lenses are cleaned with hydrogen peroxide or multipurpose contact lens solution. Recently, Proclear® Multifocal, another brand produced by the same company, has also been imported, which is of the same design, but uses omafilcon to suit those with problems of dry eyes[6].

The company recommends that the lenses be used by wearing the D lens on the dominant eye and the N lens on the other, giving the dominant eye the ability to see distant objects while giving the non-dominant eye the ability to see near objects. However, some consumers are uncomfortable with wearing the lenses as recommended. Some myopic presbyopes prefer to wear D lenses on both eyes, while emmetropic presbyopes like to wear an N lens only on the non-dominant eye. Some like to only wear the D lens on the dominant eye, while some like to wear the D lens and N lens as recommended. As for hyperopic presbyopes, some like to wear the N lens on both eyes, some like to wear the D lens in



gure 14.26 The Frequency 55 Multifocal lenses (CooperVision)

Figure 1. *Design of multifocal contact lenses (The Frequency® 55 multifocal lenses, CooperVision) (รูปสีท้ายเล่ม)*

both eyes. As can be seen, there is a large variety of patterns in which users choose to wear contact lenses. In addition, using this type of contact lenses has some disadvantages. Studies done by Hutnik and O'Hagan found that this type of lens can worsen distance vision and stereopsis of both far and near objects to a certain degree, but is acceptable if used only occasionally[10]. Rajagopalan and colleagues also found that if used to correct the vision of presbyopes, they may decrease contrast sensitivity as well[11].

The fact that using this type of lens to correct presbyopia has not become popular in Thailand may be because ophthalmologists are not yet acquainted with this new type of lenses, or that this type of lens is too complicated to prescribe to patients, or that ophthalmologists are unsure of its quality. Therefore, the researcher has conducted a study to evaluate the appropriateness of the various patterns in which this type of contact lenses can be worn to treat presbyopia, so as to make using such lenses a viable choice of treatment for presbyopes in the future.

Materials and Methods

The study was conducted on presbyopes with the following characteristics: male or female between the age of 40 to 60 years old, have received treatment for presbyopia at the Thammasat University Hospital, must have astigmatism of less than 0.75 diopters, must not have any other eye diseases or previous eye surgery, and must have given consent to participate in the study. The monthly Frequency® 55 Multifocal contact lenses were used in this study, which the characteristics of the lenses were mentioned in the introduction. The research design divided the subjects into 3 groups according to their distance vision and the applied pattern in wearing the contact lenses as in Figure 2. In the myopic presbyope group, neither N lens + N lens pattern nor only N lens pattern was used because they worst distance vision exactly. In the hyperopic presbyope group, the only N lens pattern was not used because it worst distance vision exactly, while the D lens + D lens pattern improved distance vision and may improve near vision. In the

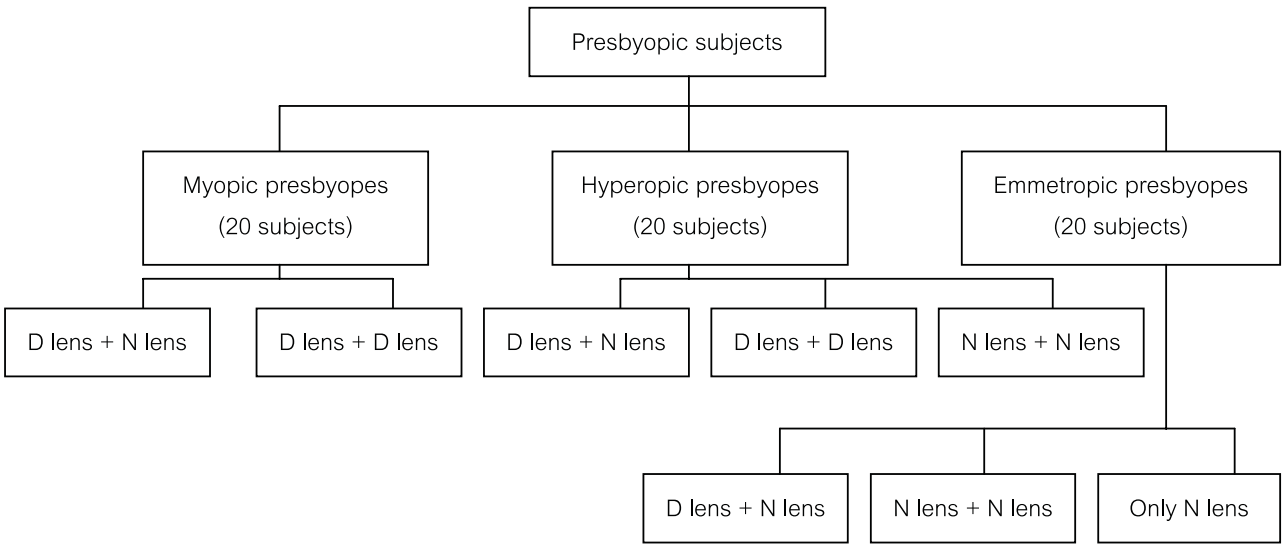


Figure 2. *Grouping of presbyopic subjects corrected with patterns of multifocal contact lenses.*

emmetropic presbyope group, the D lens + D lens pattern was not used because it worst near vision exactly.

Calculations for the sample sizes as the following formulas were conducted[12]:

$N = (Z_\alpha + Z_{2\beta})^2(\text{Varient})/\delta^2$, $\alpha = 0.05$, $\beta = 0.2$

$N = (1.96+0.842)^2\ (0.825 \times 0.175) / (0.95-0.7)^2$

$N = 18$

Therefore, the total number of subjects in each group was taken to be at least[18].

Each group of subjects was evaluated on their vision quality of both eyes, using the Snellen chart for distance vision and the Rosenbaum pocket vision screener chart for near vision, and stereopsis using the Titmus stereo test.

The procedure to apply the lenses and to study the effects was as follows:

1. The subjects were examined and screened for eye diseases or the conditions which may not allow them to wear contact lenses.

2. Each subject group was refracted for distance in each eye and near power was added using the available power of the contact lenses, and evaluated for vision.

3. The measured distance power was converted to the appropriate contact lenses power.

4. Each subject was tested for eye dominance using the Dolman method.

5. Each subject then applied his or her contact lenses accordingly, using each pattern for 1 to 2 weeks according to the convenience of the subjects. The N lens was applied for the non-dominant eye in the D lens + N lens pattern and only N lens pattern.

6. Each subject was then evaluated for vision quality for each pattern of contact lenses application every 1 to 2 weeks.

7. Each subject received proper education on the proper use and cleaning of the contact lenses, as well as the side effects, which might develop following the study. The subjects could consult the researcher and had the option to terminate their participation at any time.

The results of this study have been collected and have undergone statistical analysis using Pearson Chi-square, average, frequency, and percentage.

Results

A total of 60 subjects participated in the study, with an average age of 45.52 years old, 85% female 15% male. The majority (76.67%) were civil servants or employees of state enterprises with an average monthly income of 24,878 baht; as many as 51.67% had a Bachelor's Degree. All of them had worn spectacles, and 18.33% had ever worn contact lenses. None of the subjects experienced any serious complications from using the lenses except dry eye in some participants, which could be treated with artificial tears.

Group 1: There were a total of 20 myopic presbyopes, 90% and 85% of which had distance vision wearing contact lenses equivalent to best corrected vision in the pattern of D lens + N lens and D lens + D lens, respectively, which was not statistically significant (p=0.633). Meanwhile, near vision was found to have been significantly affected, with 95% and 30% having near vision equivalent to best corrected vision, respectively, which was statistically significant (p=0.000). As for stereopsis, 65% and 50% had stereopsis equivalent to best corrected vision in the respective patterns, a difference which was not statistically significant (p=0.337) as presented in Table 1.

Group 2: There was a total of 20 hyperopic presbyopes. A total of 95%, 95%, and 70% had distance vision equivalent to best corrected vision

when wearing the assigned contact lenses in the pattern of D lens + N lens, D lens + D lens, and N lens + N lens, respectively, which was statistically significant (p=0.039). A total of 80%, 5%, and 95% had near vision equivalent to best corrected vision when wearing the assigned contact lenses in the same respective patterns, which was statistically significant (p=0.000). As for stereopsis, 25%, 10% and 30%, respectively had stereopsis equivalent to best corrected vision, which was not statistically significant (p=0.381) as recorded in Table 2.

Group 3: The group consisted of 20 emmetropic presbyopes. It was found that 95%, 35%, and 100% of the subjects had distance vision equivalent to best corrected vision when wearing contact lenses in the pattern of D lens + N lens, N lens + N lens, and only N lens on a non-dominant eye, respectively, which was statistically significant (p=0.000). Meanwhile, it was found that 80%, 100%, and 90% had near vision equivalent to best corrected vision when wearing the respective patterns, with no statistical significance (p=0.150). As for stereopsis, 50%, 50% and 45%, respectively had stereopsis equivalent to best corrected vision, which was not statistically significant (p=0.935) as recorded in Table 3.

Ninety-five of the total 160 (59.38%) were found to have stereopsis decrease from the best corrected vision. However, all patterns still had stereopsis; the minimum was at 200 sec. of arc.

Discussion

The study was conducted to determine the most optimal pattern to wear contact lenses by comparing to the best corrected vision. The subjects were divided

Table 1. Visual outcome of myopic presbyopes corrected with various patterns of multifocal contact lenses.

Visual outcome compared to best corrected vision	Number (%)		Pearson Chi-Square
	D lens + N lens	D lens + D lens	
Equal distance vision	18 (90.00)	17 (85.00)	p=0.633
Decreased distance vision	2 (10.00)	3 (15.00)	
Equal near vision	19 (95.00)	6 (30.00)	p=0.000
Decreased near vision	1 (5.00)	14 (70.00)	
Equal stereopsis	13 (65.00)	10 (50.00)	p=0.337
Decreased stereopsis	7 (35.00)	10 (50.00)	

Table 2. Visual outcome of hyperopic presbyopes corrected with various patterns of multifocal contact lenses.

Visual outcome compared to best corrected vision	Number (%)			Pearson Chi-Square
	D lens + N lens	D lens + D lens	N lens + N lens	
Equal distance vision	19 (95.00)	19 (95.00)	14 (70.00)	p=0.039
Decreased distance vision	1 (5.00)	1 (5.00)	6 (30.00)	
Equal near vision	16 (80.00)	1 (5.00)	19 (95.00)	p=0.000
Decreased near vision	4 (20.00)	19 (95.00)	1 (5.00)	
Equal stereopsis	5 (25.00)	2 (10.00)	6 (30.00)	p=0.381
Decreased stereopsis	15 (75.00)	18 (90.00)	14 (70.00)	

Table 3. Visual outcome of emmetropic presbyopes corrected with various patterns of multifocal contact lenses.

Visual outcome compared to best corrected vision	Number (%)			Pearson Chi-Square
	D lens + N lens	N lens + N lens	Only N lens	
Equal distance vision	19 (95.00)	7 (35.00)	20 (100.00)	p=0.000
Decreased distance vision	1 (5.00)	13 (65.00)	0 (0.00)	
Equal near vision	16 (80.00)	20 (100.00)	18 (90.00)	p=0.150
Decreased near vision	4 (20.00)	0 (0.00)	2 (10.00)	
Equal stereopsis	10 (50.00)	10 (50.00)	9 (45.00)	p=0.935
Decreased stereopsis	10 (50.00)	10 (50.00)	11 (55.00)	

into 3 groups. Group 1 consisted of myopic presbyopes, which did not have a difference of distance vision and stereopsis after wearing the contact lenses in both patterns, but had a significant difference for near vision when wearing the contact lenses in the pattern of D lens + N lens. Hence, myopic presbyopes are recommended to wear the pattern D lens + N lens as was recommended by the manufacturer. In Group 2, hyperopic presbyopes had the least improved distance vision quality when wearing the contact lenses in the pattern of N lens + N lens, while wearing them in the patterns of D lens + N lens and D lens + D lens resulted in an equally improved distance vision quality. The least improved near vision quality was found when subjects in the group wore the pattern D lens + D lens, while the N lens + N lens pattern was found to result in the most improved near vision quality. As for stereopsis, there was no significant difference. Therefore, hyperopic presbyopes are recommended to wear the contact lenses in the pattern of D lens + N lens as recommended by the manufacturer, the same pattern recommended to myopic presbyopes. In Group 3, emmetropic presbyopes had the least improved distance vision quality wearing the contact lenses in the pattern of N lens + N lens, while the most improved distance vision was demonstrated when wearing only N lens on a non-dominant eye, which yielded similar results as the pattern of wearing D lens + N lens. The pattern of wearing only N lens resulted in a slightly more improved distance vision quality. However, near vision quality and stereopsis were not significantly affected with all patterns. Therefore, emmetropic presbyopes are recommended to wear the only N lens on a non-dominant eye, which is more economical, while the manufacturer's recommended pattern of D lens + N lens is also a viable option as it did not yield a significant disadvantage. Stereopsis was found to decrease by more than half, with group 2 subjects, hyperopic presbyopes, found to have the most decreased stereopsis. However, all patterns still had stereopsis, which is in accordance with Hutnik and O'Hagan[10].

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