

Comparing Trifocal IOL's and Mini-Monovision Principles, Planning and Outcomes: A South African Private Practice Study

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Abstract

Objective: In the context of an increasing trend to offer patients refractive outcomes, cataract surgeons need to have a wide offering of presbyopic solutions. The objective was to investigate patient satisfaction and to establish which parameters are ideal when using monofocal IOLs for mini-monovision and trifocal multifocal IOLs for nearvision solution after lens extraction.

Design and Methods: This private practice based study reviews 63 patients who either underwent FineVision® trifocal IOL (n = 28) implantation or B&L Akreos for mini-monovision (n = 35).

Uncorrected distance, intermediate and near vision were measured as well as stereo acuity. An in-house questionnaire based on the Catquest was developed to assess overall patient satisfaction, ease with 12 visual tasks, spectacle independence, whether they would have the surgery again and if they would recommend it to someone else. Post-operative surgical interventions such as Lasik, AK and YAG capsulotomy are also mentioned

Results: The vast majority of both groups were very satisfied and both groups had almost equal rating with distance tasks. The FineVision® group rated more ease with near tasks and perceived depth perception. The mini-monovision group rated more ease with intermediate tasks and less bothersome dysphotopsias. Complete spectacle independence was achieved in 85% of the FineVision® group and 48% of the mini-monovision group.

Conclusion: Providing surgeons with reliable practice-based feedback can increase their confidence in offering premium lenses to patients. The study facilitates the refractive surgeon on patient selection for mini-monovision or multifocal intra-ocular lenses.

Introduction

Cataract surgery rates (CSR) are steadily increasing. The Global intra-ocular lens market is forecast to reach \$3.1 billion by 2017 due to the ageing population and impact of diabetes [1]. The WHO expects cataract surgery to reach 32 million per annum worldwide by 2020 [2].

To eliminate cataract blindness in the South African public sector, the cataract surgery rate should be at least 100 000 per annum (2000 per million population) [3]. In the private sector, ophthalmologist number approximately 324 country-wide [4]. It is here where the art of cataract surgery as a refractive outcome is gaining momentum. JA Krüger practice averages 350-400 cataract surgeries per year.

Due to direct to consumer marketing of premium IOL's, a more informed public will increasingly expect more customized surgical outcomes [5].

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JA Krüger practice has seen an adoption rate of 16.6% in multifocal and 9.6% in toric IOL's in 2014. One can expect this number to grow - in the US, the adoption of premium IOL's has increased from 14% to 24% since 2011 [6]. Studies show that conversion rates also increase as surgeons demonstrate more assertiveness in offering premium lenses, don't wait till BCVA is less than 6/12 and provide pre-consultation educational information on lens options [5-7].

As spectacle independence becomes the normalized expectation, it is essential for the surgeon to have a bouquet of offerings that will best satisfy the patient's visual outcomes. Current presbyopic IOL solutions include multifocal IOL's, full monovision and mini-monovision (or blended monovision) (See Table 1 for comparison of these principles) [8-18].

	Advantages	Disadvantages
Multifocal IOL's	Binocular summation with bilateral implantation Spectacle free under almost all conditions	Complex optics of simultaneous focal points require neural adaptation Glasses do not improve vision in absence of refractive error Loss of contrast sensitivity Magnifies corneal and retinal problems Dysphotopsias Higher co-payments Certain personality types cannot accept the optics of the design
Full Monovision (2.00 to 3.50D of induced myopia)	Good distance and near vision. Clearer image quality. Higher satisfaction rate as binocular functions deteriorate (over 70y) Can be reversed by wearing glasses Less costly. High refractive predictability and less sensitive to decentration	Loss of Binocular summation due to suppression. Asthenopia risk Intermediate vision loss Low light spectacles often required.
Mini Monovision (0.75 to 1.75D of induced myopia)	Good distance and intermediate vision. Allows fusion and binocular summation. No prolonged neural adaptation, less asthenopia, low risk of intolerance. Natural ageing of eye and macular functions not compounded over life-time. Can be reversed by wearing glasses Less costly. High refractive predictability and less sensitive to decentration	Spectacles for 40 cm tasks, occasionally night time driving

Table 1: Comparison of presbyopic solutions.

By doing a review of results and investigating patient satisfaction and parameters used, the refractive cataract surgeon can optimise results and the usage of either mini-monovision with monofocal IOLs or trifocal multifocal IOLs and therefore optimise their usage. This study has helped to streamline the suitability for these two options.

Materials and Methods

In this article, the FineVision® trifocal to B&L Akreos for mini-monovision will be compared (See Lens properties in Table 2).

	FineVision®	B&L Akreos
Design	Aspheric	Aspheric
Focality and % of light energy distribution	Trifocal with 26 diffractive steps 43% for distance 15% for 1.75 intermediate addition 28% for 3.50 near addition	Uniform Monofocal
Power	+10.00 to +30.00	0.0 to + 30.00
Filtering	Light Yellow Cromophore	Clear UV blocker

Table 2: IOL properties.

This was a retrospective study with 63 patients who had no ocular pathology or previous refractive surgery. Based on patient stated visual outcomes and shared decision making principles, either implantation for a trifocal (n = 28) or mini-monovision (n = 35) was determined (See Demographics of participants in Table 3).

	FineVision®	B&L Akreos
Average age	60.6 (range:49-70)	61.7 (range: 42-81)
Male	50%	32%
Female	50%	68%
OD dominant	71%	45%
OS dominant	29%	55%

Table 3: Participant Demographics.

For the mini-monovision group, ocular dominance was determined [19]. The dominant eye was targeted for distance vision [20,21]. However, some authors regard this as non-essential and/or it may be reversed if near/intermediate tasks are prioritized [22-24].

The mini-monovision group had a one week contact lens trial period [25]. Although the induced myopia was adapted to individual needs, the average target was -1.25 DS. A threshold target of 1.50 is accepted by 87% of patients [19]. It is also documented that 1.25 appears to be more effective in pseudophakia than phakia due the enhanced depth perception provided by positive spherical aberration in pseudophakia [19,22].

All IOL planning included Pentacam and macular optical coherence tomography scans, refraction, intra-ocular pressure measurement, endothelial cell count, ZEISS IOL master and multiformulae calculation comparisons.

Phaco-emulsification and IOL implants occurred first in the non-dominant eye, and a week later in the dominant eye. As patient satisfaction is often related to vision in the dominant eye [26], this allows for any IOL power alterations that may be required.

Post-operative clinical outcomes were measured from 6 weeks to 18 months and included uncorrected distance, intermediate (60 cm) and near vision (40 cm), as well as stereopsis with Randot® stereo testing.

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There is an international trend to see if clinical outcomes match patient perception of outcomes [27]. Patient’s rating of functional tasks also adds credibility to clinical outcomes. In this light, an in-house questionnaire was developed based on the Catquest [28], but adapted to practice needs for quality control. The questionnaire assessed patient’s overall satisfaction rating; the ease/difficulty of 12 visual tasks covering various working distances; the need for spectacles at various distances; if they would have the surgery again; and if they would recommend it to someone else (Figure 1).

PATIENT SATISFACTION QUESTIONNAIRE					
Which type of lenses did you receive	MULTIFOCAL LENSES			<input type="radio"/>	DATE:
	MONOVISION LENSES			<input type="radio"/>	
Are you satisfied or dissatisfied with your present vision	VERY DISSATISFIED	RATHER DISSATISFIED	FAIRLY SATISFIED	VERY SATISFIED	CANNOT DECIDE
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do you experience that your present vision is giving difficulty in in any way in your everyday life	YES , VERY GREAT DIFFICULTIES	YES , GREAT DIFFICULTIES	YES , SOME DIFFICULTIES	NO , NO DIFFICULTIES	CANNOT DECIDE
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do you have difficulty with the following activities because of your vision:					
• Reading text in the newspaper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
• See to do handwork, woodwork, hobbies, etc.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
• See prices when shopping	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
• Using your cell phone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
• Working on the computer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
• Recognise the faces of people you come across	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
• Reading text on TV	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
• Driving during the day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
• Driving at night	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
• Are you affected by glare or halo's	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
• Judging distances / watching a 3-D movie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
• Seeing to walk on uneven ground and / or stairs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do you need to wear spectacles:	YES , PERMANENTLY	YES , ONLY FOR DRIVING	YES , ONLY FOR COMPUTER	YES , ONLY FOR READING	NO, NOT AT ALL
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Would you have this surgery again	YES		NO	UNDECIDED	
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Would you recommend this surgery to somebody else	YES		NO	UNDECIDED	
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 1: In-house Patient satisfaction questionnaire.

Patients that were unhappy with their outcome in terms of reading ability without glasses under specific circumstances were closely reviewed in order to establish why they were unhappy. This helps to optimise results and usage.

Results

We acknowledge that in our private practice setting we have not employed sophisticated statistical analysis principles, but a rather a more common-day and decimal acuity feedback.

Regarding the Safety index, the FineVision® (1.0) and mini-monovision (1.08) groups performed comparably indicating that there is no loss of BCVA in either group. The Efficacy index slightly favours the mini-monovision (1.07) to the FineVision® (0.94) indicating that UCVA post operatively is slightly better than BCVA pre-operatively in that group.

The uncorrected distance vision showed that the 60% of the FineVision® group achieved 1.0 vision with only the dominant eye and 72% of the mini-monovision achieved 1.0 VA (Figure 2). The spherical equivalent for distance BCVA in both groups showed that 99% were between -0.50 and + 0.50D. The average spherical equivalent for the near BCVA in the mini-monovision group was -1.50D.

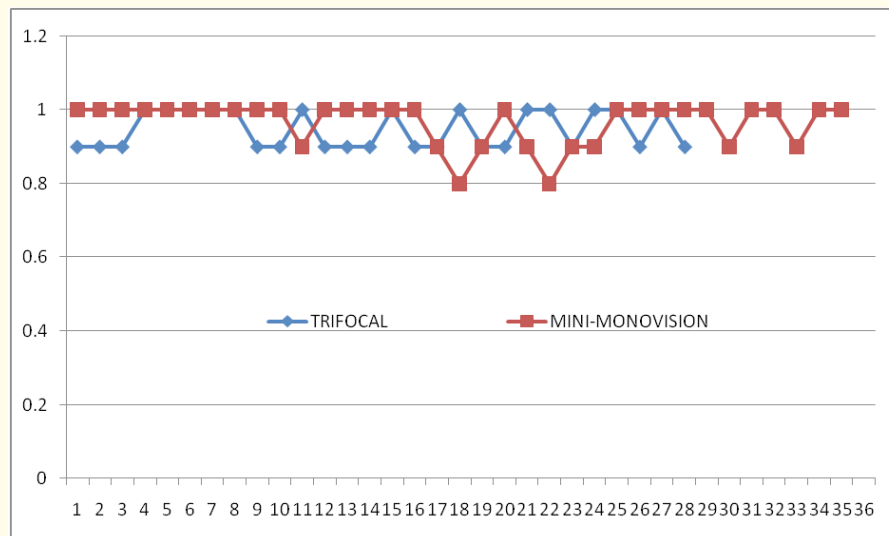


Figure 2: Uncorrected Distance Vision in Dominant Eye (Decimal).

The average binocular UCVA at 40 cm was 0.8 in the FineVision® group and 0.67 in the mini-monovision group (Figure 3).

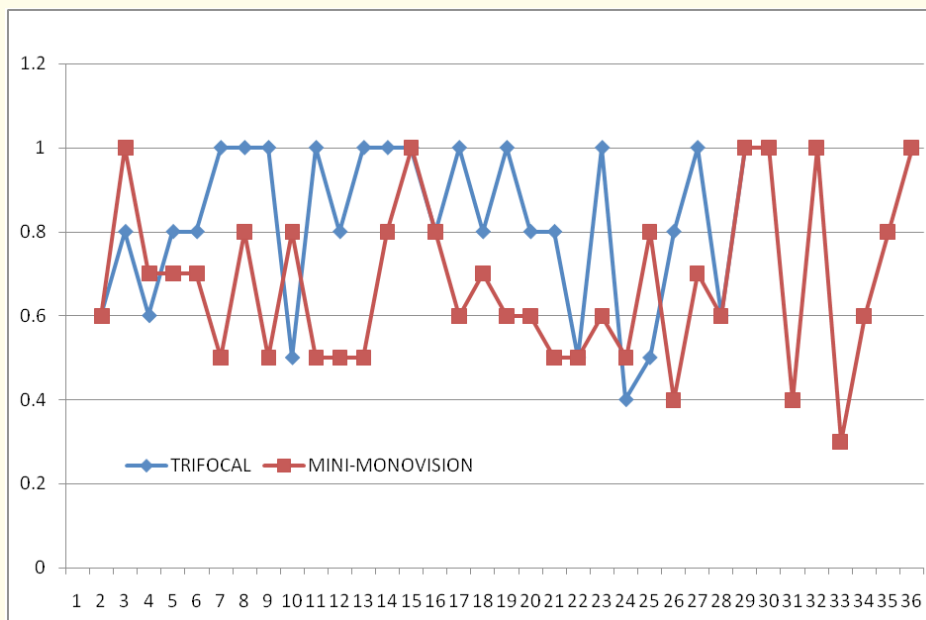


Figure 3: Uncorrected Near acuity @ 40 cm (Decimal).

The average binocular UCVA at 60 cm was 0.46 in the FineVision® group and 0.6 in the mini-monovision group (Figure 4).

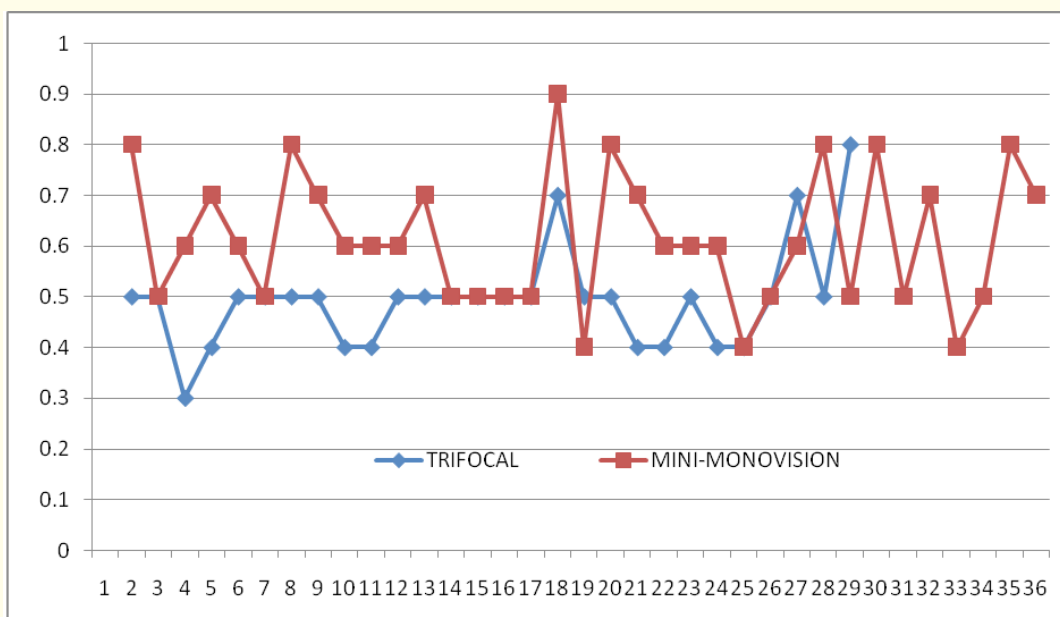


Figure 4: Uncorrected Intermediate acuity @ 60 cm (Decimal).

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Randot® Stereo testing show that 25% of the FineVision® group and 33% of the mini-monovision group have 60% or more stereo acuity (Figure 5).

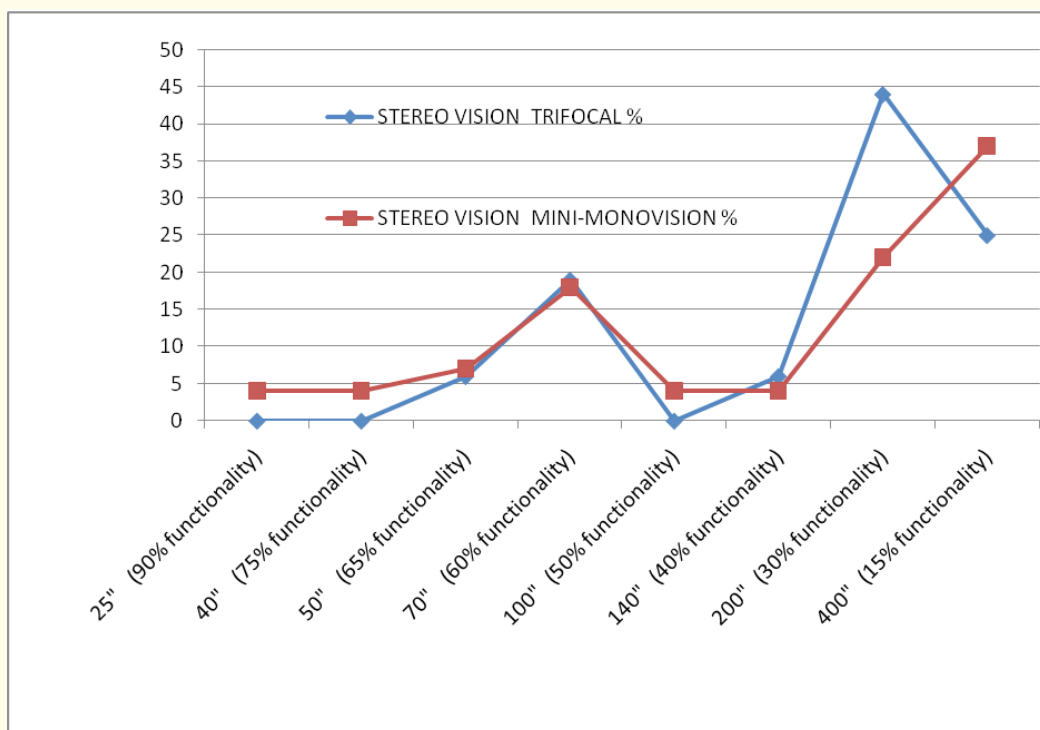


Figure 5: Randot ® Stereo Vision.

Our results are similar to other research done on the FineVision ® lens [29-31].

Regarding the patient questionnaire feedback, overall satisfaction with the outcome of the surgery was 90% in the FineVision® group and 100% in the mini-monovision. Satisfaction tended to increase as time elapsed (e.g. 6 weeks vs. 3 month's).

Both groups had equal satisfaction rating for distance tasks. The FineVision® group rated more ease with near tasks and perceived depth perception. The mini-monovision group rated more ease with intermediate tasks. There were less "moderate-to-severe" complaints of dysphotopsias in the mini-monovision group (13%) as compared to the FineVision® group (35%). The latter corresponds to patients experiencing photic phenomena after multifocal IOL implantation [32].

85% of FineVision® participants were completely spectacle free at all distances, where 52% of mini-monovision needed spectacles for either reading or driving. This is slightly higher than comparative research [24]. Whether they would have the surgery again, 75% of FineVision® participants and 91% of mini-monovision stated that they would. Quality of vision was the major reservation for the FineVision® participants. The majority of both multifocal and mini-monovision participants would recommend it to somebody near and dear to them.

Post-operative surgical interventions included Lasikor astigmatic keratotomy in 3.5% of FineVision® group and 8% of mini-monovision group. Comparative studies show 5.7% multifocal IOL explantation [24] and an enhancement rate of 10% in mulifocals [33] and 20% in mini-monovision [23]. Residual astigmatism is stated as a key factor. Yag Capsulotomy was done in 44% of the FineVision® group within the first 3 months and for 12% of mini-monovision within the first 6 months.

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Discussion and Conclusion

In the current study the vast majority of both groups were highly satisfied with their results. This corresponds with a literature overview of 16 studies comparing multifocal IOL's to mono-vision [34].

We found that patients with mini-monovision could function very well in the day in good light. Could read their cellphones and easily work on the computer. Even in sport such as golf it can work well. However they struggled when reading books particularly for longer periods and suffered tiredness. In contrast the trifocal IOL patients could read books easier and people who read books and documents at say 40 cm were more suited to trifocal IOLs. They however still had to use good light and some patients experienced glare and haloes. Due to the fact that they were counselled preoperatively, glare and haloes effect was accepted more readily postoperatively. Generally these trifocal patients wanted and were happy with their binocular distance vision.

The satisfaction rate of FineVision® corresponds to a previous practice study with Lentis M-plus IOL. In our practice experience, MF lenses seem especially suited to hyperopes and mini-monovision to myopes. Such feedback helps the surgeon become more confident in offering options and Premium IOL's to patients. An international study showed that amongst surgeons, 67% are "satisfied" to "very satisfied" with multifocal lenses in their practice [35]. Specifically, surgeon's experience with FineVision® lens are positive, predictable and stable [36]. European trends show that trifocal IOL's are becoming the first choice of multifocal implantations [29].

Offering refractive presbyopic solutions is very rewarding and can be a great practice builder - but only if the patient is happy with the outcome. Therefore, it requires much more chair time due to patient education and participation in deciding on realistic visual expectations. After-care can also be more demanding as dealing with early patient adjustment requires the right attitude and appropriate psychological, pharmaceutical and surgical responses [36]. For this reason, costing factors are important, offering laser vision correction (LVC) as an inclusive package or discounted option also needs to be considered [6].

Although price might be the major obstacle for patients, their motivation for the convenience of spectacle independence is the greatest deciding factor toward choosing multifocal IOL's. As customized refractive outcome trends will only increase, surgeons are encouraged not to shy away from multifocal IOL's and to gain more experience with and confidence in premium IOL implants.

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