TORIC TRIFOCAL IOL TREATMENT WITH HIGH ASTIGMATISM AND HYPEROPIA VS RELEX SMILE ENHANCEMENT

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15 June 2020

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Toric trifocal IOL treatment with high astigmatism and hyperopia
vs
SMILE enhancement after trifocal IOL treatment with high astigmatism and hyperopia

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Abstract

Purpose: The aim of this study was to assess visual and refractive outcomes after toric trifocal lens implantation and also visual outcomes after laser vision correction with SMILE to correct residual refraction after 6 months trifocal lens (IOL) implantation. Another objective was to proof that SMILE surgery in pseudophakic patients with trifocal IOL is safe, effective, and predictable in a large cohort of patients.

Setting: One site in Prishtina, Eye Hospital, Kosovo

Design: Non-randomized prospective comparative study

Methods: This prospective comparative study reviewed 40 eyes treated with trifocal toric lens implanatation in the first group and 40 eyes in the second group were treated with Relex SMILE for the reduction of the residual refractive error following 6 months after trifocal lens implantation. First group's patients received a toric trifocal IOL implantation, second's group patients received a spheric trifocal IOL and SMILE enhancement after 6 months.

The SMILE surgery was performed with the VisuMax device (Carl Zeiss Meditec, Jena, Germany). After laser treatment the lenticule was extracted through the SMILE incision (size between 2 – 4 mm). For the treatment of pseudophakic eyes the IOP increase during the laser treatment has to be very low. Vetter et al. have shown that the IOP increase with the VusMax device is only up to 63+/-22 mmHg *(Vetter et al, Intraocular Pressure During Corneal Flap Preparation: Comparison Among Four Femtosecond Lasers in Porcine Eyes, Journal of Refractive Surgery • Vol. 27, No. 6, 2011)* .

The mean length of follow-up was 6 months (range 1 to 12 months) and mean interval between trifocal lens implantation and SMILE surgery was 6 months. Visual acuity (VA) at distance was tested at 5 m, VA at intermediate distance at 80 cm and VA at near vision at 40 cm. Other outcome measurements are refraction, patient satisfaction, and quality of life. The latter was evaluated at the last available visit.

Results: The analysis included 40 eyes of 20 patients implanted with the trifocal IOL and 40 eyes of 20 patients implanted with the trifocal toric IOL, with no clinically significant differences between groups. 4 eyes of 2 patients of the 2nd group (SMILE after trifocal), patients were unhappy. Those patients underwent fresh lenticule implantation after 3 months and improved within 1week post op.

Conclusion: Relex Smile surgery in pseudophakic patients with trifocal IOL was shown to be safe, effective, and predictable in a large cohort of patients. In conclusion, the current study demonstrates that both the non-toric and toric versions of the trifocal IOL evaluated here provide excellent functional vision to patients, with good distance, intermediate and near uncorrected VA, a wide range of vision and good contrast sensitivity.

Key words: SMILE in pseudophakic patients, trifocal IOL, toric trifocal IOL

INTRODUCTION

The current state of the art for the correction of aphakia and presbyopia after lens extraction and refractive lensectomy is the implantation of multifocal intraocular lenses (IOL). In this study, the trifocal IOL types AT LISA TRI 839MP and toric AT LISA TRI TORIC 939MP (Carl Zeiss Meditec, Jena, Germany) were assed.

MATERIAL AND METHODS

Population of the study

In this prospective non-randomized study patients with spherical hypermetropia of >4 D in combination with high astigmatism of >3.0 D were treated. The first group of 40 eyes of 20 patients underwent refractive lensectomy, followed by implantation of the diffractive trifocal IOL type AT LISA TRI 839MP (Carl Zeiss Meditec, Jena, Germany) and 6 months later SMILE surgery. In 40 eyes of 20 patients in the second group IOL type AT LISA TRI TORIC 939MP were implanted. All patients were adequately consulted preoperatively about this type of IOLs and they were verbally consented. The study is adherent to the tenets of the Declaration of Helsinki. All patient are between 20- 45 years old.

Inclusion and exclusion criteria

The included patients were seeking spectacle independence with pre-operative high spherical hypermetropia over 4 D or higher and astigmatismus >2 D or higher. Some patients had amblyopia or strabismus (accommodative esotropia) suitable for refractive lens exchange.

Exclusion criteria were history of glaucoma, retinal detachment, corneal disease, irregular corneal astigmatism, abnormal iris, macular degeneration, advanced retinopathy, neuro ophthalmic disease, cataract, keratoconus, history of ocular inflammation, or previous ocular surgery

Preoperative and postoperative assessments

Prior to the surgical procedure, a complete ocular examination was done, including slit lamp examination, Goldman applanation tonometry, measurement of uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA) and corrected near visual acuity (CNVA), manifest refraction, keratometry and biometry (IOL Master v.4.3, Carl Zeiss Meditec, Jena, Germany), corneal topography (ATLAS, Carl Zeiss Meditec, Dublin, USA) and fundoscopy. The IOL Master and keratometry data were used to corroborate the Atlas 9000; other biometric data (axial length, white-to-white, anterior chamber depth) from the IOL Master were used for the IOL sphere calculation, considering results from the SRK-T, Haigis, Hoffer Q and Holladay formulas. In this study we used the Hoffer Q formula. Toric IOL calculations were made using the keratometric data from the Zeiss ATLAS 9000 and IOL Master and zcalc.

Postoperative evaluation was performed on 1st day, 1 week, 1st month, 3rd month and 6th month after the second eye surgery. The postoperative protocol was identical to preoperative one with the additional evaluation of monocular and binocular uncorrected (UIVA) intermediate visual acuity (80 cm) and monocular and binocular near visual acuity (40 cm) under the photic condition. Careful assessment of the status of IOL was done to look for any posterior capsular opacity (PCO) or malposition.

Surgical technique

All surgeries were performed by one experienced surgeon using a standard technique of sutureless phacoemulsification. In all cases, topical anesthesia was administered and pharmacologic mydriasis was induced using a combination of tropicamide and phenylephrine (10.0%). A mean clear corneal microincision of 2.2 mm was made with a knife according to position of the preop highest K value of the patient. A paracentesis was made 60 degree to 80 degree, clockwise from the main incision, and the anterior chamber was filled with an ophthalmic viscoelastic (OVD) after phacoemulsification/lensectomy and removal of clear lens. The IOL was subsequently implanted through the main incision using the BLUEMIXS 180 injector (Carl Zeiss meditec, Jena, Germany) for trifocal IOL , VISCOJECT^{TM} BIO injector for toric trifocal IOL and then the OVD was removed. Postoperative pharmacologic treatment is performed with the combination of antibiotic and steroidal anti-inflammatory drops.

Intraocular lens

Both AT LISA TRI 839MP and AT LISA TRI TORIC 939MP (for significant regular astigmatism) IOLs are designed for aphakia correction after crystalline lens removal. They are designed to be implanted into an intact capsular bag as a microincision IOL, and no enlargement of the incision (1.8 mm) is needed with the Bluemixs injector. The IOL material is a biocompatible hydrophilic copolymer with UV filter. The IOL material has 25% of water content at 35° C. The IOLs are trifocal within a lens diameter of 4.3 mm and bifocal between 4.3 mm and 6 mm diameter. The add powers within the 4.3 mm diameter are 1.66 diopters to intermediate and 3.33 diopters to near distance. The add power between the 4.3 mm and 6 mm diameter is 3.75 diopters.

Results

Uneventful surgery?

Visual acuity

In group 1 (IOL + SMILE) 6 months' post-op the UCVA values are mostly better in near and intermediate than pre-op CDVA, but for far vision we found a decrease in many cases. After post-IOL SMILE enhancements, UCVA values increased for near, intermediate and far distance.

6 months after SMILE treatment the number of eyes is highest with an increase of 0.1 for near vision between post-op UCVA and pre-op UCVA (SMILE treatment day). For intermediate distance the highest number eyes have increased 0.2 between post-op UCVA and pre-op UCVA (SMILE treatment day).For far distance the highest number of eyes have increased 0.3 between post-op UCVA and pre-op UCVA (SMILE treatment day).

In group 2 (toric IOL), 6 months' post-op the UCVA are better than CDVA pre-op at all distances. In groups 2, for all distances (near, intermediate and far), after 3 months, the number of eyes having the same post-op UCVA like pre-op CDVA is highest. And in this group 2, after 6 months, the number of eyes with an increase of 0.1 of post-op UCVA over pre-op CDVA is highes. Also in group 2, after 6 months, the number of eyes with an increase of 0.2 of post-op UCVA over pre-op CDVA is highest. The results are also shown in Figure X.

Conclusion

The non-toric and toric trifocal IOLs provided good distance, intermediate and near vision to patients, with a wide range of vision and good contrast sensitivity.

In conclusion, the current study demonstrates that both the non-toric and toric versions of the trifocal IOL evaluated here provide excellent functional vision to patients, with good distance, intermediate and near uncorrected VA, a wide range of vision and good contrast sensitivity. Relex Smile surgery in pseudophakic patients with trifocal IOL was safe, effective, and predictable in a large cohort of patients. It is noteworthy that the decision for a treatment strategy (toric IOL or non-toric IOL with SMILE in s second step) should be made carefully, to select the appropriate method for the patient . During phaco surgey the positions of incisions should be determined according to the angle of the highest K value of the patient. For high astigmatic patients, toric trifocal IOL are highly effective.

			6 Month after trifocal					6 months after Relex Smile without glassess					Difference
Nr.			1Day	1Weak	1Month	3Month	6Month	1Day	1Weak	1Month	3Month	6Month	
1	Refaction	+6.50, +2.5ax75											
	Near	0.8 cc	0.50	0.80	0.80	0.80	0.80	0.80	0.80	0.90	0.90	0.90	0,1
	Intermediate	0.7 cc	0.60	0.60	0.70	0.70	0.70	0.70	0.70	0.80	0.80	0.80	0,1
	Far	0.6 cc	0.30	0.3	0.50	0.50	0.50	0.50	0.60	0.70	0.70	0.70	0,1
2	Refaction	+6.00, +2.00 AX 96											
	Near	0.70 cc	0.60	0.60	0.70	0.80	0.80	0.80	0.90	0.90	0.90	0.90	0,2
	Intermediate	0.40 cc	0.40	0.50	0.50	0.60	0.60	0.70	0.70	0.70	0.70	0.70	0,7
	Far	0.60 cc	0.30	0.40	0.40	0.40	0.40	0.60	0.60	0.80	0.80	0.80	0,2
3	Refaction	+4.50, +2.0 AX 110											
	Near	1.0 cc	0.80	0.80	0.80	1.00	1.00	0.9	0.90	0.90	1.00	1.00	0
	Intermediate	0.90 cc	0.70	0.70	0.70	0.90	0.90	0.80	0.80	0.90	1.00	1.00	0,1
	Far	0.80 cc	0.30	0.30	0.50	0.60	0.60	0.70	0.70	0.80	0.90	0.90	0,1
4	Refaction	+5.00, +2.50 AX 65											
	Near	0.90 cc	0.70	0.70	0.80	0.80	0.80	0.90	0.90	0.90	1.00	1.00	0,1
	Intermediate	0.80 cc	0.60	0.60	0.70	0.70	0.70	0.80	0.80	0.80	0.90	0.90	0,1
	Far	0.70 cc	0.30	0.40	0.50	0.60	0.60	0.70	0.70	0.70	0.80	0.80	0,1
5	Refaction	6.25, +2.75 AX 113											
	Near	0.70 cc	0.50	0.60	0.70	0.70	0.70	0.70	0.70	0.70	0.80	0.80	0,1
	Intermediate	0.60 cc	0.40	0.50	0.60	0.60	0.60	0.60	0.60	0.60	0.70	0.70	0,1
	Far	0.50 cc	0.20	0.30	0.30	0.40	0.40	0.50	0.50	0.50	0.60	0.60	0,1
6	Refaction	+60, +2.25 AX 70											
	Near	0.80 cc	0.60	0.60	0.70	0.70	0.70	0.70	0.80	0.90	0.90	0.90	0,1
	Intermediate	0.70 cc	0.50	0.50	0.60	0.60	0.60	0.60	0.70	0.80	0.80	0.80	0,1
	Far	0.60 cc	0.30	0.30	0.40	0.40	0.40	0.50	0.60	0.70	0.70	0.70	0,1
7	Refaction	+5.50, +3.00 AX 95											
	Near	0.70 cc	0.50	0.50	0.60	0.70	0.70	0.70	0.70	0.70	0.80	0.80	0,1
	Intermediate	0.60 cc	0.40	0.40	0.50	0.60	0.60	0.60	0.60	0.60	0.70	0.70	0,1
	Far	0.50 cc	0.70	0.70	0.70	0.80	0.80	0.50	0.50	0.50	0.60	0.70	0,2
8	Refaction	+6.00, +2.75 AX 85											
	Near	0.80 cc	0.60	0.60	0.60	0.70	0.70	0.70	0.80	0.80	0.80	0.80	0
	Intermediate	0.60 cc	0.40	0.40	0.40	0.50	0.50	0.60	0.60	0.60	0.60	0.60	0
	Far	0.50 cc	0.20	0.20	0.30	0.40	0.40	0.50	0.70	0.70	0.70	0.70	0,2
9	Refaction	+4.25, +3.25 AX 75											
	Near	0.80 cc	0.60	0.60	0.70	0.80	0.80	0.80	0.80	0.80	0.90	0.90	0,1
	Intermediate	0.70 cc	0.50	0.50	0.60	0.70	0.70	0.70	0.70	0.70	0.80	0.80	0,1
	Far	0.60 cc	0.30	0.30	0.40	0.40	0.40	0.60	0.60	0.60	0.70	0.70	0,1
10	Refaction	+4.50, +2.75AX 105											
	Near	0.80 cc	0.60	0.60	0.80	0.80	0.80	0.80	0.80	0.80	0.90	0.90	0,1

	Intermediate	0.70 cc	0.50	0.50	0.70	0.70	0.70	0.70	0.70	0.70	0.80	0.80	0,1
	Far	0.60 cc	0.30	0.30	0.40	0.40	0.40	0.60	0.70	0.60	0.70	0.70	0,1

			6 Month after trifocal					**6 months after Relex Smile without glassess**					**Difference**
Nr.			**1Day**	**1Week**	**1Month**	**3Month**	**6Month**	**1Day**	**1Week**	**1Month**	**3Month**	**6Month**	
	Refaction	+7.00, +2.00 AX 100											
11	**Near**	0.70 cc	0.60	0.60	0.60	0.60	0.60	0.70	0.70	0.70	0.80	0.80	0,1
	Intermediate	0.60 cc	0.50	0.50	0.50	0.50	0.50	0.60	0.60	0.60	0.70	0.70	0,1
	Far	0.50 cc	0.20	0.30	0.30	0.40	0.40	0.50	0.50	0.50	0.60	0.60	0,1
12	**Refaction**	+7.00, +2.50 AX 80											
	Near	0.60 cc	0.50	0.50	0.50	0.50	0.50	0.60	0.60	0.60	0.70	0.70	0,1
	Intermediate	0.50 cc	0.40	0.40	0.40	0.40	0.40	0.50	0.50	0.50	0.60	0.60	0,1
	Far	0.40 cc	0.10	0.10	0.30	0.30	0.30	0.40	0.40	0.40	0.50	0.50	0,1
13	**Refaction**	+5.00, +2.00 AX 95											
	Near	0.90 cc	0.60	0.60	0.60	0.70	0.80	0.80	0.90	0.90	0.90	0.90	0
	Intermediate	0.80 cc	0.50	0.50	0.50	0.60	0.70	0.70	0.80	0.80	0.90	0.90	0,1
	Far	0.70 cc	0.40	0.40	0.40	0.50	0.50	0.60	0.70	0.70	0.80	0.80	0,1
14	**Refaction**	+5.50, +2.00 AX 90											
	Near	0.90 cc	0.50	0.70	0.70	0.70	0.70	0.80	0.80	0.90	0.90	0.90	0
	Intermediate	0.70 cc	0.40	0.60	0.60	0.60	0.60	0.70	0.70	0.80	0.80	0.80	0,1
	Far	0.60 cc	0.30	0.30	0.30	0.40	0.40	0.60	0.60	0.70	0.70	0.70	0,1
15	**Refaction**	+7.50, +2.50 AX 65											
	Near	0.50 cc	0.40	0.40	0.40	0.50	0.50	0.50	0.50	0.60	0.60	0.70	0,2
	Intermediate	0.40 cc	0.30	0.30	0.30	0.40	0.40	0.40	0.40	0.50	0.50	0.60	0,2
	Far	0.30 cc	0.10	0.10	0.20	0.20	0.20	0.30	0.30	0.40	0.40	0.50	0,2
16	**Refaction**	+7.00,+2.75 AX 115											
	Near	0.50 cc	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.60	0.60	0.70	0,2
	Intermediate	0.40 cc	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.50	0.50	0.60	0,2
	Far	0.30 cc	0.10	0.10	0.20	0.20	0.20	0.30	0.30	0.40	0.40	0.50	0,2
17	**Refaction**	+5.75, +2.00 AX 105											
	Near	1.00 cc	0.80	0.80	0.80	0.80	0.80	1.00	1.00	1.00	1.00	1.00	0
	Intermediate	0.90 cc	0.70	0.70	0.70	0.70	0.70	0.90	0.90	0.90	1.00	1.00	0,1
	Far	0.80 cc	0.40	0.40	0.40	0.50	0.50	0.80	0.80	0.80	0.90	0.90	0,1
18	**Refaction**	+5.75, +2.25 AX 65											
	Near	1.00 cc	0.70	0.70	0.70	0.70	0.70	0.90	0.90	1.00	1.00	1.00	0
	Intermediate	0.90 cc	0.60	0.60	0.60	0.60	0.60	0.70	0.70	0.80	0.80	0.80	-0,1
	Far	0.80 cc	0.40	0.40	0.40	0.50	0.50	0.80	0.80	0.90	0.90	0.90	0,1
19	**Refaction**	+4.75, +2.00 AX70											
	Near	1.00 cc	0.70	0.70	0.70	0.80	0.80	1.00	1.00	1.00	1.00	1.00	0

	Intermediate	0.90 cc	0.60	0.60	0.60	0.70	0.70	0.90	0.90	0.90	0.90	0.90	0
	Far	0.80 cc	0.40	0.40	0.50	0.60	0.60	0.80	0.80	0.90	0.90	0.90	0,1
20	**Refaction**	+4.75, +2.50AX 115											
	Near	1.00 cc	0.70	0.70	0.70	0.70	0.70	0.80	0.80	0.90	0.90	0.90	0,2
	Intermediate	0.90 cc	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.70	0.80	-0,1
	Far	0.80 cc	0.30	0.30	0.40	0.50	0.50	0.70	0.70	0.80	0.90	0.90	0,1

			6 Month after trifocal					6 months after Relex Smile without glassess					Difference
Nr.			**1Day**	**1Week**	**1Month**	**3Month**	**6Month**	**1Day**	**1Week**	**1Month**	**3Month**	**6Month**	
21	**Refaction**	+5.50, +3.00 AX 60											
	Near	0.70 cc	0.60	0.60	0.60	0.60	0.60	0.60	0.70	0.70	0.70	0.70	0
	Intermediate	0.60 cc	0.40	0.40	0.40	0.40	0.40	0.40	0.60	0.60	0.60	0.60	0
	Far	0.50 cc	0.30	0.30	0.30	0.30	0.30	0.50	0.70	0.70	0.70	0.70	0,2
22	**Refaction**	+6.00,+2.00 AX 20											
	Near	0.70 cc	0.60	0.60	0.60	0.60	0.60	0.70	0.70	0.70	0.70	0.70	0
	Intermediate	0.60 cc	0.40	0.40	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	-0,1
	Far	0.50 cc	0.30	0.30	0.30	0.40	0.40	0.60	0.60	0.60	0.70	0.70	0,2
23	**Refaction**	+6.25, +3.25 AX120											
	Near	0.40 cc	0.50	0.50	0.50	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0,2
	Intermediate	0.30 cc	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.50	0.50	0,2
	Far	0.20 cc	0.20	0.20	0.20	0.20	0.20	0.30	0.30	0.30	0.40	0.40	0,2
24	**Refaction**	+6.75, +3.0 AX 65											
	Near	0.30 cc	0.40	0.40	0.40	0.40	0.40	0.50	0.50	0.50	0.50	0.50	0,2
	Intermediate	0.20 cc	0.30	0.30	0.30	0.30	0.30	0.40	0.40	0.40	0.40	0.40	0,2
	Far	0.10 cc	0.10	0.10	0.10	0.20	0.20	0.30	0.30	0.30	0.30	0.30	0,2
25	**Refaction**	+5.00, +2.00 AX 90											
	Near	0.80 cc	0.60	0.60	0.60	0.70	0.70	0.80	0.80	0.80	0.90	0.90	0,1
	Intermediate	0.70 cc	0.50	0.50	0.50	0.60	0.60	0.70	0.70	0.70	0.80	0.80	0,1
	Far	0.60 cc	0.40	0.40	0.40	0.40	0.40	0.60	0.60	0.60	0.70	0.70	0,1
26	**Refaction**	+5.50, +2.50 AX 125											
	Near	0.80 cc	0.70	0.70	0.70	0.70	0.70	0.80	0.80	0.80	0.90	0.90	0,1
	Intermediate	0.70 cc	0.60	0.60	0.60	0.60	0.60	0.70	0.70	0.70	0.80	0.80	0,1
	Far	0.60 cc	0.40	0.40	0.40	0.50	0.50	0.60	0.60	0.60	0.70	0.70	0,1
27	**Refaction**	+6.00, +2.25 AX 60											
	Near	0.50 cc	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.60	0.60	0.60	0,1
	Intermediate	0.40 cc	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.50	0.50	0.50	0,1
	Far	0.20 cc	0.10	0.10	0.10	0.20	0.20	0.30	0.30	0.40	0.40	0.40	0,2
28	**Refaction**	+6.00, +2.75 AX98											
	Near	0.40 cc	0.40	0.40	0.40	0.40	0.40	0.50	0.50	0.50	0.60	0.60	0,2

	Intermediate	0.30 cc	0.30	0.30	0.30	0.30	0.30	0.40	0.40	0.40	0.50	0.50	0,2
	Far	0.20 cc	0.20	0.20	0.20	0.20	0.20	0.30	0.30	0.30	0.40	0.40	0,2
29	**Refaction**	+9.00, +2.0 AX 115											
	Near	0.20 cc	0.20	0.20	0.30	0.30	0.40	0.50	0.50	0.50	0.60	0.60	0,4
	Intermediate	0.20 cc	0.20	0.20	0.20	0.20	0.30	0.40	0.40	0.40	0.50	0.50	0,3
	Far	0.10 cc	0.10	0.10	0.20	0.20	0.20	0.30	0.30	0.30	0.40	0.40	0,3
30	**Refaction**	+9.00, +2.50 AX 55											
	Near	0.30 cc	0.40	0.40	0.40	0.50	0.50	0.50	0.60	0.60	0.60	0.60	0,3
	Intermediate	0.20 cc	0.30	0.30	0.30	0.40	0.40	0.40	0.50	0.50	0.50	0.50	0,3
	Far	0.10 cc	0.20	0.20	0.20	0.30	0.30	0.30	0.40	0.40	0.40	0.40	0,3

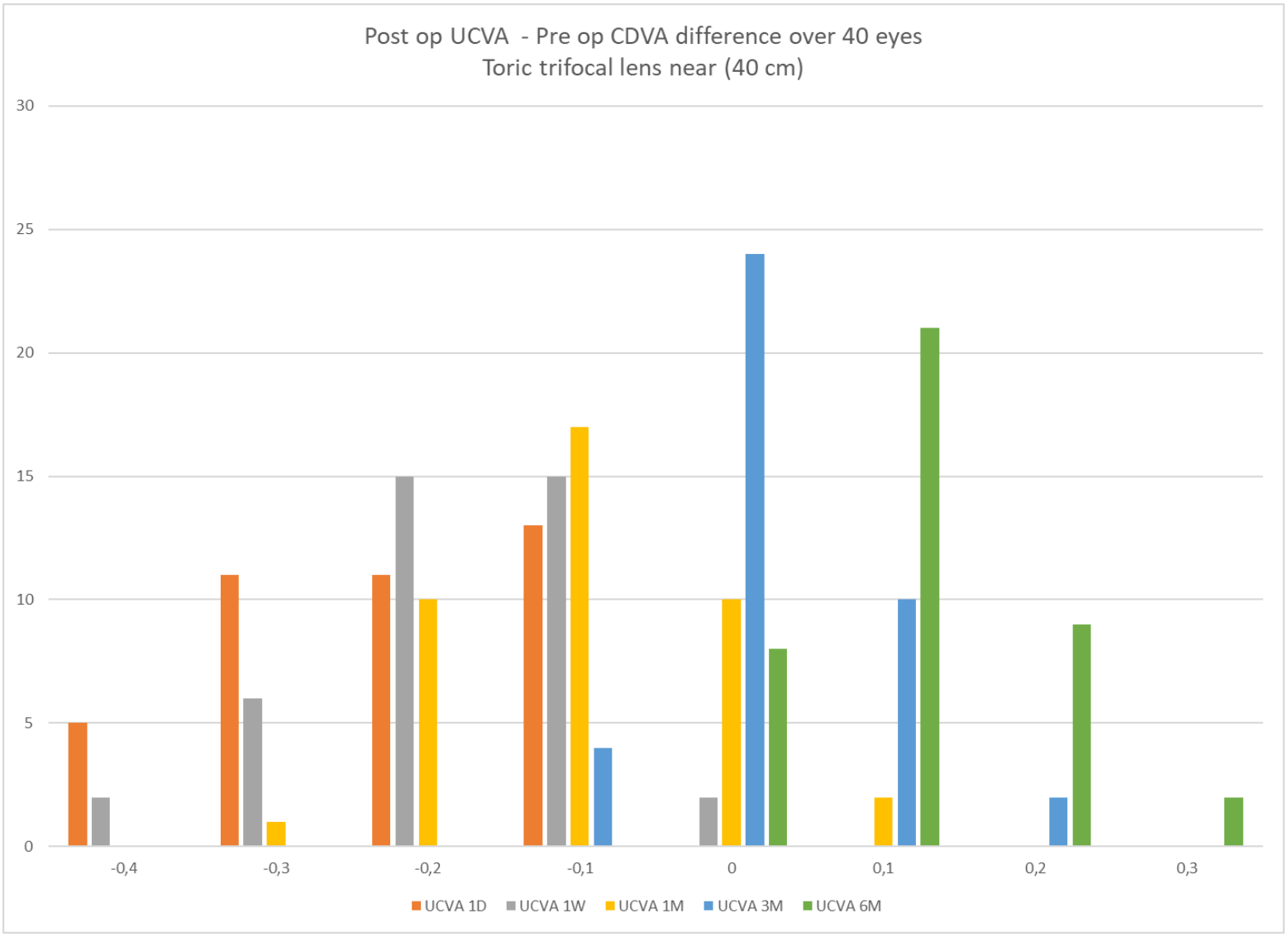
			6 Month after trifocal					**6 months after Relex Smile-without glassess**					**Difference**
Nr.			**1Day**	**1Weak**	**1Month**	**3Month**	**6Month**	**1Day**	**1Weak**	**1Month**	**3Month**	**6Month**	
31	**Refaction**	+8.00, +2.75 AX 50											
	Near	0.30 cc	0.40	0.40	0.40	0.40	0.40	0.50	0.50	0.60	0.60	0.50	0,1
	Intermediate	0.20 cc	0.20	0.20	0.30	0.30	0.30	0.40	0.40	0.50	0.50	0.30	0,1
	Far	0.10 cc	0.10	0.10	0.20	0.20	0.20	0.30	0.30	0.40	0.40	0.40	0,3
32	**Refaction**	+8.50, +2.25 AX 136											
	Near	0.30 cc	0.40	0.40	0.40	0.40	0.40	0.50	0.50	0.60	0.50	0.50	0,1
	Intermediate	0.20 cc	0.30	0.30	0.30	0.20	0.30	0.40	0.40	0.30	0.30	0.30	0
	Far	0.10 cc	0.20	0.20	0.20	0.30	0.30	0.30	0.30	0.40	0.40	0.40	0,2
33	**Refaction**	+10.00, +2.0 AX 90											
	Near	0.20 cc	0.20	0.20	0.30	0.30	0.30	0.40	0.40	0.50	0.50	0.50	0,3
	Intermediate	0.10 cc	0.10	0.10	0.20	0.20	0.20	0.30	0.30	0.40	0.40	0.40	0,3
	Far	0.10 cc	0.10	0.10	0.20	0.20	0.20	0.20	0.20	0.30	0.30	0.30	0,2
34	**Refaction**	+10.00, +2.50 AX 90											
	Near	0.20 cc	0.30	0.30	0.30	0.30	0.30	0.30	0.40	0.40	0.40	0.40	0,1
	Intermediate	0.10 cc	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0
	Far	0.10 cc	0.20	0.20	0.20	0.20	0.20	0.30	0.30	0.30	0.30	0.30	0,1
35	**Refaction**	+5.00, +2.25 AX 90											
	Near	0.80 cc	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.90	0.90	0.90	0,1
	Intermediate	0.70 cc	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.90	0.90	0.70	0
	Far	0.60cc	0.40	0.40	0.40	0.50	0.50	0.60	0.60	0.70	0.70	0.80	0,4
36	**Refaction**	+5.25, +2.25 AX 96											
	Near	0.80 cc	0.80	0.80	0.80	0.80	0.80	0.70	0.80	0.90	0.90	0.90	0,1
	Intermediate	0.70 cc	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.70	0.70	0,1
	Far	0.60 cc	0.30	0.40	0.40	0.40	0.40	0.60	0.70	0.70	0.80	0.80	0,5
37	**Refaction**	+7.50, +4.25 AX 75											
	Near	0.30 cc	0.30	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0,1

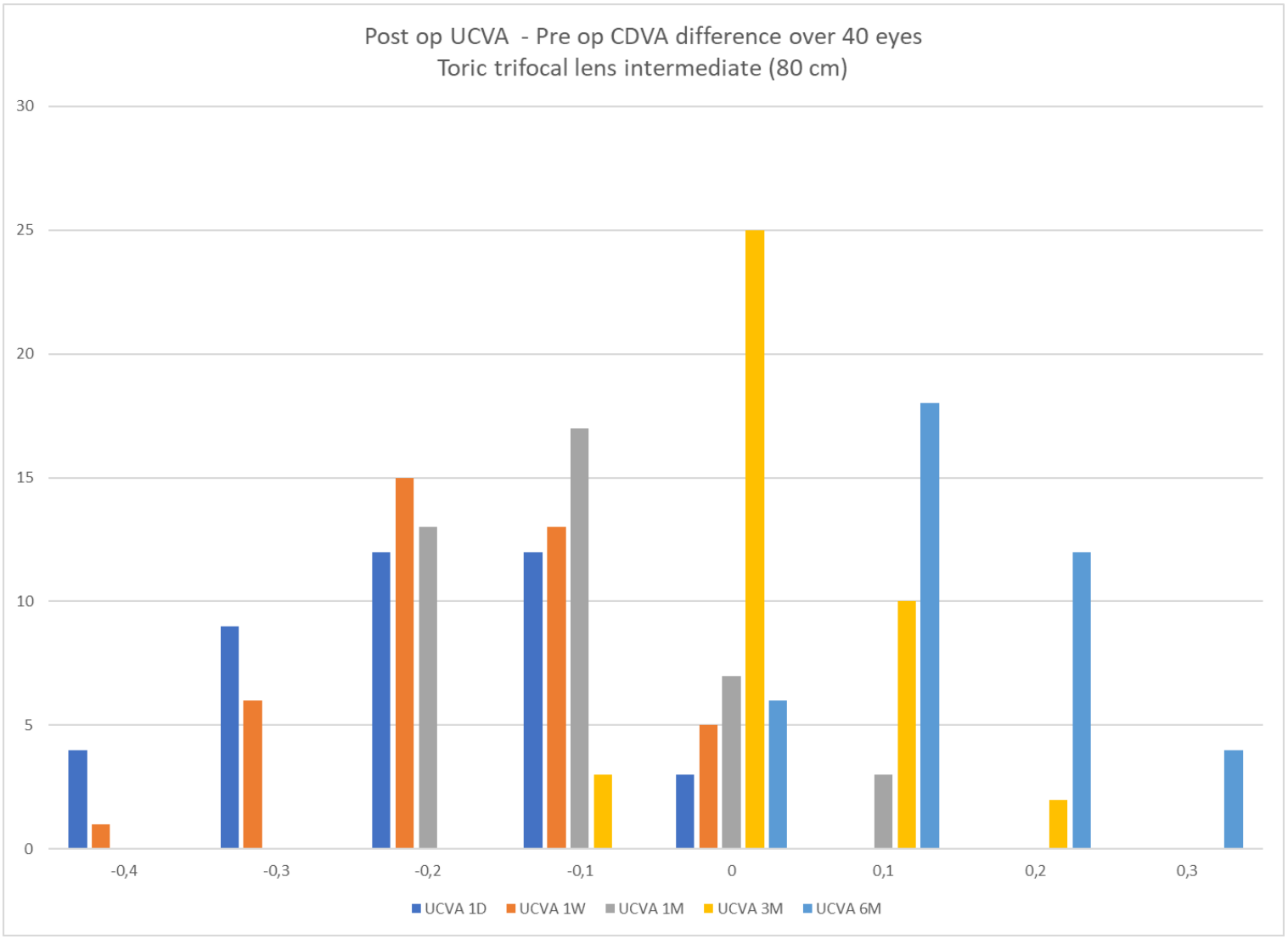
	Intermediate	0.20 cc	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0	
	Far	0.10 cc	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0	
38	**Refaction**	+8.00, +4.50 AX 115												
	Near	0.30 cc	0.30	0.30	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0,1	
	Intermediate	0.20 cc	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0	
	Far	0.10 cc	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0	
39	**Refaction**	+8.50, +4.0 AX 105												
	Near	0.30 cc	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0	
	Intermediate	0.20 cc	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0	
	Far	0.10 cc	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0	
40	**Refaction**	+9.00, +4.0 AX 75												
	Near	0.30 cc	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0	
	Intermediate	0.20 cc	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0	
	Far	0.10 cc	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0	

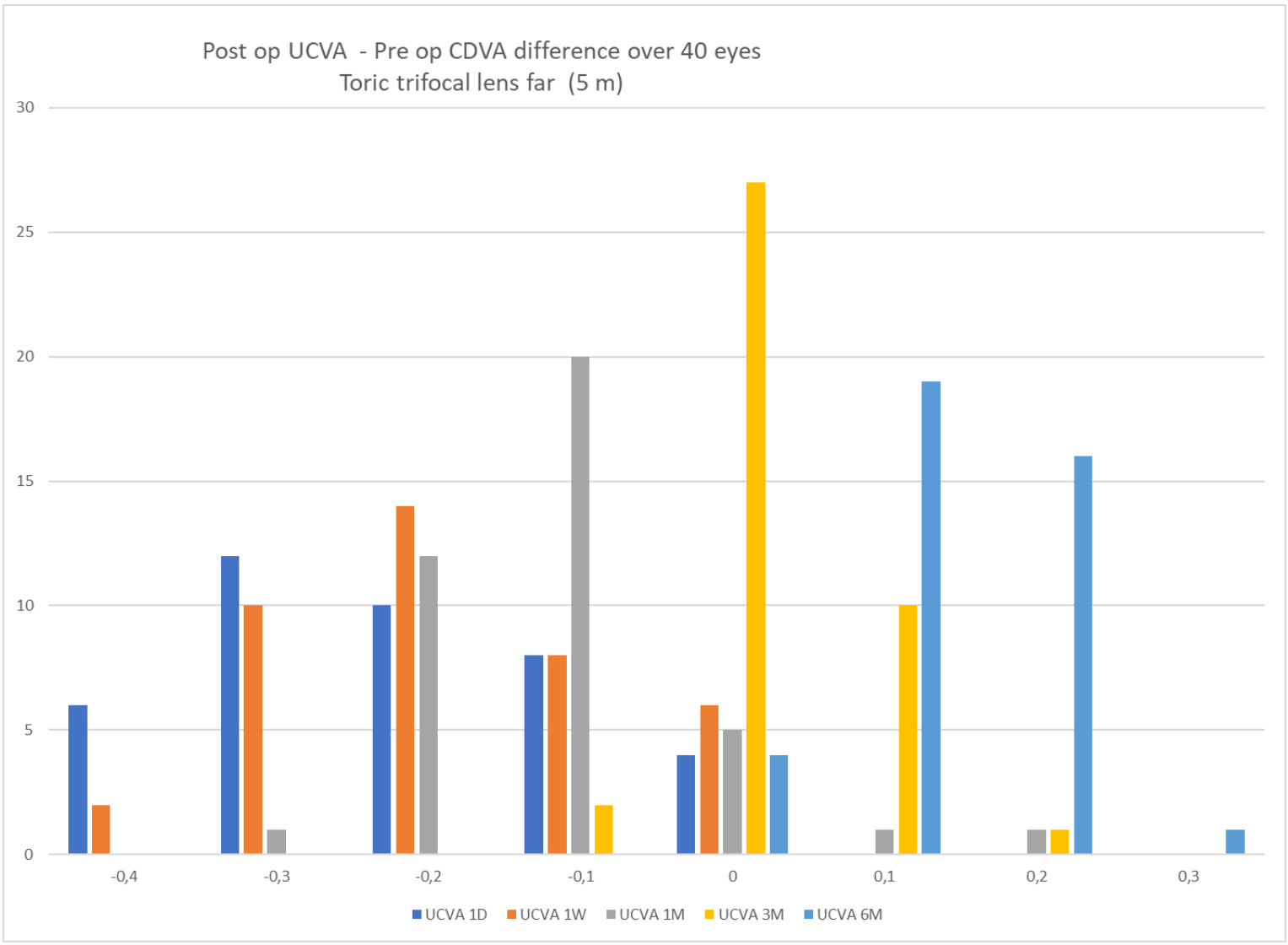
Toric Trifocal

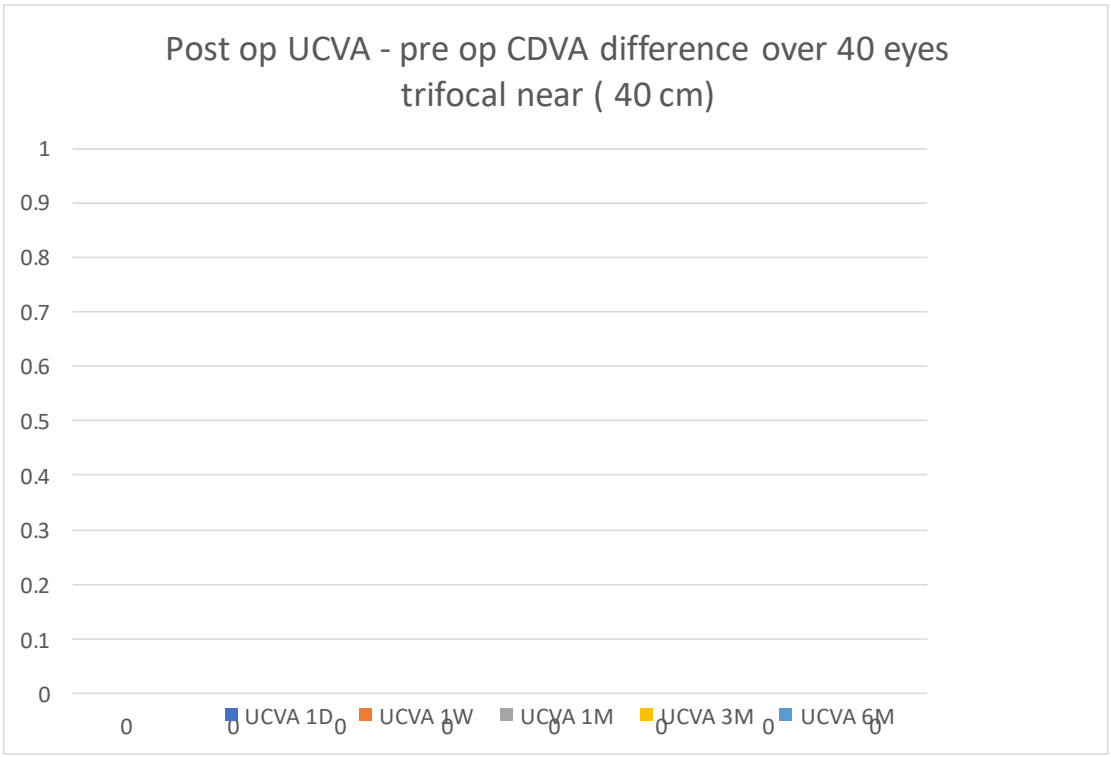
	pre w glasses			**pre w glasses**			**post 1st day**			**post 1 week**			**post 1 month**			**Post 3 month**			**Post 6 month**				
Eye	**sph**	**cly**	**angle**	**near**	**inter.**	**far**	**near**	**İnter.**	**far**	**near**	**İnter.**	**far**	**near**	**İnter.**	**far**	**near**	**İnter.**	**far**	**near**	**İnter.**	**far**		
1	5,5	2,75	110	0,9	0,8	0,7	0,7	0,6	0,4	0,8	0,6	0,5	0,8	0,6	0,5	0,9	0,8	0,7	0,9	0,8	0,9	0	0
2	7	3,75	95	0,5	0,4	0,3	0,3	0,2	0,1	0,4	0,2	0,1	0,4	0,3	0,2	0,5	0,4	0,3	0,6	0,5	0,4	0,1	0,1
3	6,5	3,25	90	0,8	0,7	0,6	0,5	0,4	0,3	0,6	0,5	0,3	0,7	0,5	0,4	0,8	0,7	0,6	0,9	0,8	0,7	0,1	0,1
4	5,25	2,75	80	0,9	0,8	0,7	0,7	0,6	0,4	0,7	0,6	0,5	0,8	0,7	0,6	0,9	0,8	0,7	1	0,9	0,8	0,1	0,1
5	7	2,25	100	0,8	0,7	0,6	0,5	0,4	0,3	0,6	0,5	0,3	0,7	0,6	0,5	0,8	0,7	0,6	0,9	0,8	0,7	0,1	0,1
6	6,25	2,5	70	0,9	0,8	0,7	0,6	0,5	0,4	0,7	0,6	0,4	0,7	0,6	0,5	0,9	0,8	0,7	0,9	0,8	0,8	0	0
7	4,5	2	45	0,9	0,7	0,8	0,6	0,5	0,4	0,7	0,6	0,5	0,8	0,7	0,6	0,9	0,7	0,9	0,9	0,8	0,9	0	0,1
8	5	2	95	0,9	0,7	0,8	0,6	0,5	0,4	0,7	0,6	0,4	0,7	0,6	0,5	0,8	0,6	0,7	0,9	0,9	0,8	0	0,2
9	5,5	4	85	0,5	0,4	0,3	0,3	0,2	0,1	0,3	0,2	0,1	0,4	0,2	0,1	0,5	0,4	0,3	0,7	0,6	0,5	0,2	0,2
10	6,5	2	75	0,7	0,6	0,5	0,4	0,3	0,2	0,5	0,4	0,3	0,6	0,5	0,4	0,7	0,6	0,5	0,8	0,7	0,6	0,1	0,1
11	5,75	2,5	70	0,8	0,7	0,6	0,4	0,3	0,2	0,5	0,4	0,3	0,6	0,5	0,4	0,8	0,7	0,6	0,9	0,8	0,7	0,1	0,1
12	6,25	2,25	115	0,8	0,7	0,6	0,5	0,4	0,3	0,6	0,5	0,4	0,7	0,6	0,5	0,8	0,7	0,6	0,9	0,8	0,7	0,1	0,1
13	4,75	2	120	0,9	0,8	0,7	0,5	0,4	0,3	0,6	0,5	0,4	0,7	0,6	0,5	0,9	0,8	0,7	0,9	0,8	0,7	0	0
14	5,5	2,75	95	0,8	0,7	0,6	0,5	0,4	0,3	0,5	0,4	0,3	0,6	0,5	0,4	0,8	0,7	0,6	0,9	0,8	0,7	0,1	0,1
15	5,75	3	90	0,8	0,7	0,6	0,4	0,3	0,2	0,4	0,3	0,2	0,6	0,5	0,4	0,8	0,7	0,6	0,9	0,8	0,7	0,1	0,1
16	6,5	3,25	90	0,7	0,6	0,5	0,5	0,3	0,2	0,7	0,4	0,3	0,7	0,5	0,4	0,7	0,6	0,5	0,8	0,7	0,6	0,1	0,1
17	4,5	3,25	95	0,5	0,3	0,4	0,4	0,3	0,1	0,4	0,3	0,2	0,5	0,4	0,3	0,6	0,5	0,4	0,7	0,6	0,5	0,2	0,3
18	5	4	90	0,6	0,5	0,4	0,5	0,4	0,2	0,5	0,4	0,2	0,5	0,4	0,3	0,6	0,5	0,4	0,7	0,6	0,5	0,1	0,1
19	8	3,5	105	0,4	0,3	0,2	0,3	0,2	0,1	0,3	0,2	0,1	0,3	0,2	0,1	0,4	0,3	0,2	0,4	0,3	0,2	0	0

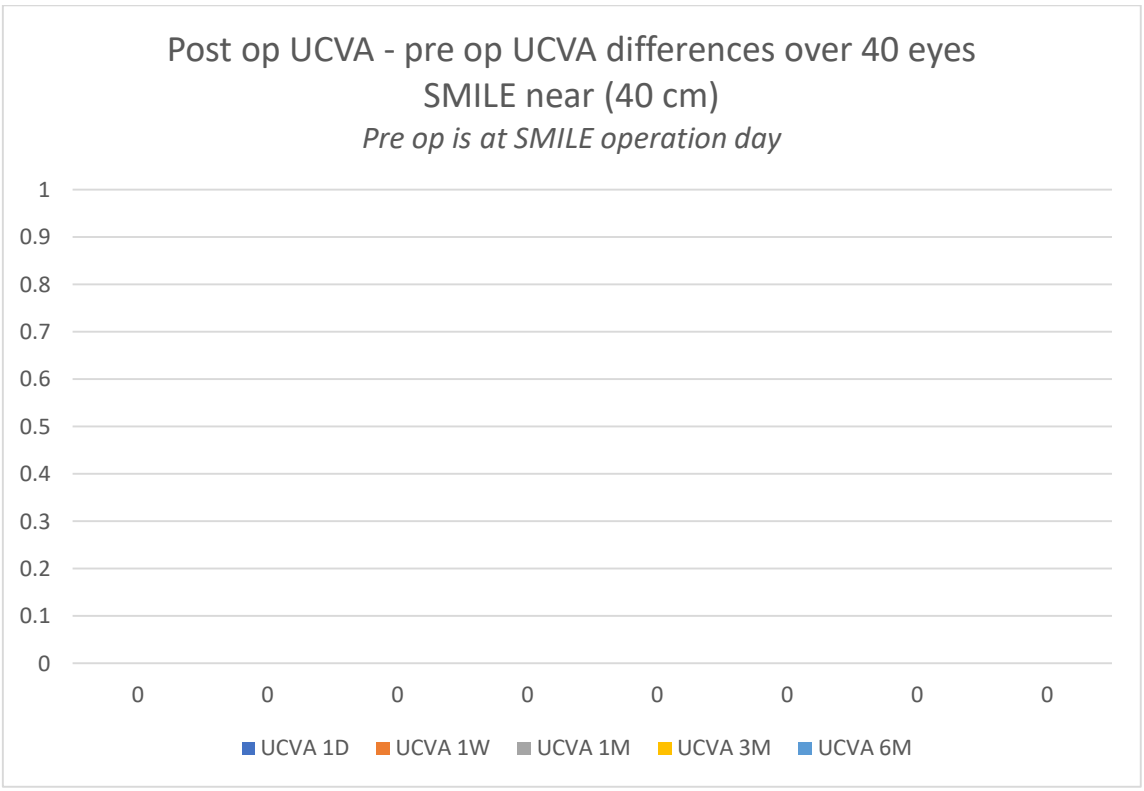
20	8	3	90	0,4	0,3	0,2	0,3	0,2	0,1	0,3	0,2	0,1	0,3	0,2	0,1	0,4	0,3	0,2	0,4	0,3	0,2	0	0
21	6	3,25	95	0,7	0,5	0,4	0,4	0,3	0,1	0,5	0,3	0,1	0,6	0,4	0,3	0,7	0,5	0,4	0,8	0,6	0,5	0,1	0,1
22	6,75	4	105	0,6	0,4	0,2	0,3	0,2	0,1	0,3	0,2	0,1	0,3	0,2	0,1	0,5	0,4	0,3	0,7	0,5	0,4	0,1	0,1
23	7	3,5	65	0,3	0,2	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,2	0,1	0,1	0,3	0,2	0,1	0,5	0,4	0,3	0,2	0,2
24	3,75	4,25	120	0,7	0,5	0,4	0,5	0,3	0,2	0,5	0,3	0,2	0,6	0,4	0,3	0,7	0,6	0,4	0,7	0,6	0,5	0	0,1
25	8,5	3,75	100	0,2	0,1	0,1	0,1	0,1	0,1	0,2	0,1	0,1	0,3	0,2	0,1	0,4	0,3	0,2	0,5	0,4	0,3	0,3	0,3
26	8,5	2,5	80	0,3	0,2	0,2	0,2	0,1	0,1	0,2	0,1	0,1	0,3	0,1	0,1	0,4	0,2	0,2	0,5	0,4	0,3	0,2	0,2
27	7	2,5	75	0,5	0,3	0,2	0,3	0,2	0,1	0,4	0,2	0,2	0,5	0,3	0,2	0,6	0,4	0,3	0,7	0,5	0,4	0,2	0,2
28	10	3	85	0,3	0,2	0,1	0,2	0,1	0,1	0,2	0,1	0,1	0,3	0,2	0,2	0,5	0,3	0,2	0,6	0,4	0,3	0,3	0,2
29	9,5	3,75	100	0,4	0,3	0,1	0,3	0,2	0,1	0,3	0,2	0,1	0,5	0,4	0,3	0,5	0,4	0,3	0,6	0,3	0,4	0,2	0
30	4	3,25	70	0,5	0,4	0,2	0,3	0,2	0,1	0,3	0,2	0,1	0,3	0,2	0,1	0,5	0,3	0,2	0,6	0,5	0,4	0,1	0,1
31	4	3,25	65	0,7	0,6	0,4	0,4	0,3	0,2	0,4	0,3	0,2	0,5	0,4	0,3	0,7	0,6	0,5	0,8	0,7	0,6	0,1	0,1
32	4,75	3,5	115	0,7	0,6	0,5	0,3	0,2	0,1	0,4	0,3	0,2	0,5	0,4	0,3	0,6	0,5	0,4	0,8	0,7	0,6	0,1	0,1
33	3,25	4,5	60	0,6	0,4	0,4	0,2	0,1	0,1	0,2	0,1	0,1	0,4	0,2	0,2	0,7	0,5	0,4	0,8	0,7	0,6	0,2	0,3
34	4,75	2,75	90	0,7	0,6	0,5	0,6	0,5	0,3	0,6	0,5	0,4	0,7	0,5	0,4	0,8	0,6	0,5	0,9	0,8	0,6	0,2	0,2
35	5	3,5	85	0,7	0,5	0,4	0,6	0,3	0,2	0,6	0,4	0,2	0,7	0,4	0,2	0,8	0,6	0,5	0,8	0,7	0,6	0,1	0,2
36	6,75	3	105	0,6	0,5	0,4	0,4	0,3	0,2	0,4	0,3	0,2	0,5	0,4	0,3	0,6	0,5	0,4	0,8	0,7	0,6	0,2	0,2
37	5,5	3,5	30	0,8	0,6	0,5	0,7	0,5	0,3	0,7	0,5	0,3	0,8	0,6	0,4	0,9	0,7	0,6	0,9	0,8	0,7	0,1	0,2
38	5	3	150	0,8	0,6	0,5	0,7	0,5	0,3	0,7	0,6	0,4	0,8	0,6	0,5	0,9	0,7	0,6	0,9	0,8	0,7	0,1	0,2
39	9,75	3,5	90	0,5	0,3	0,2	0,4	0,2	0,1	0,4	0,3	0,2	0,5	0,3	0,2	0,6	0,4	0,3	0,6	0,5	0,4	0,1	0,2
40	9	3,75	90	0,5	0,2	0,2	0,3	0,2	0,1	0,3	0,2	0,1	0,4	0,2	0,1	0,4	0,3	0,2	0,6	0,5	0,4	0,1	0,3

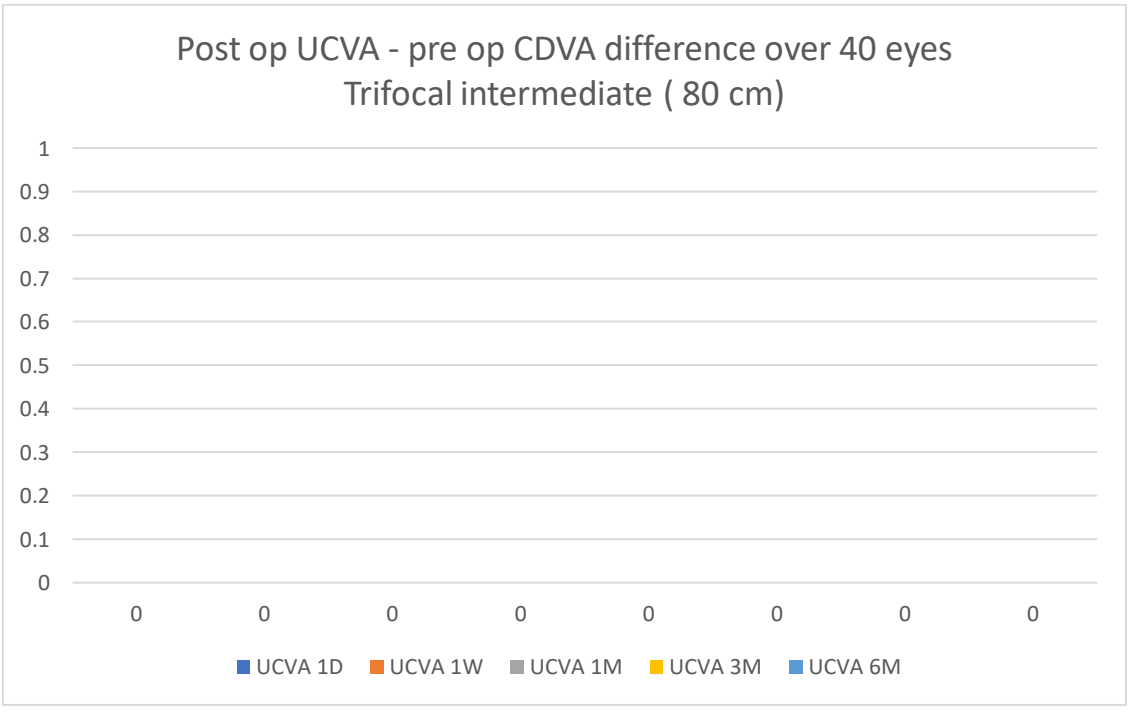

Post op UCVA - Pre op CDVA difference over 40 eyes
Toric trifocal lens near (40 cm)
30
25
20
15
10
5
0
-0,4
-0,3
-0,2
-0,1
0
0,1
0,2
0,3
UCVA 1D
UCVA 1W
UCVA 1M
UCVA 3M
UCVA 6M

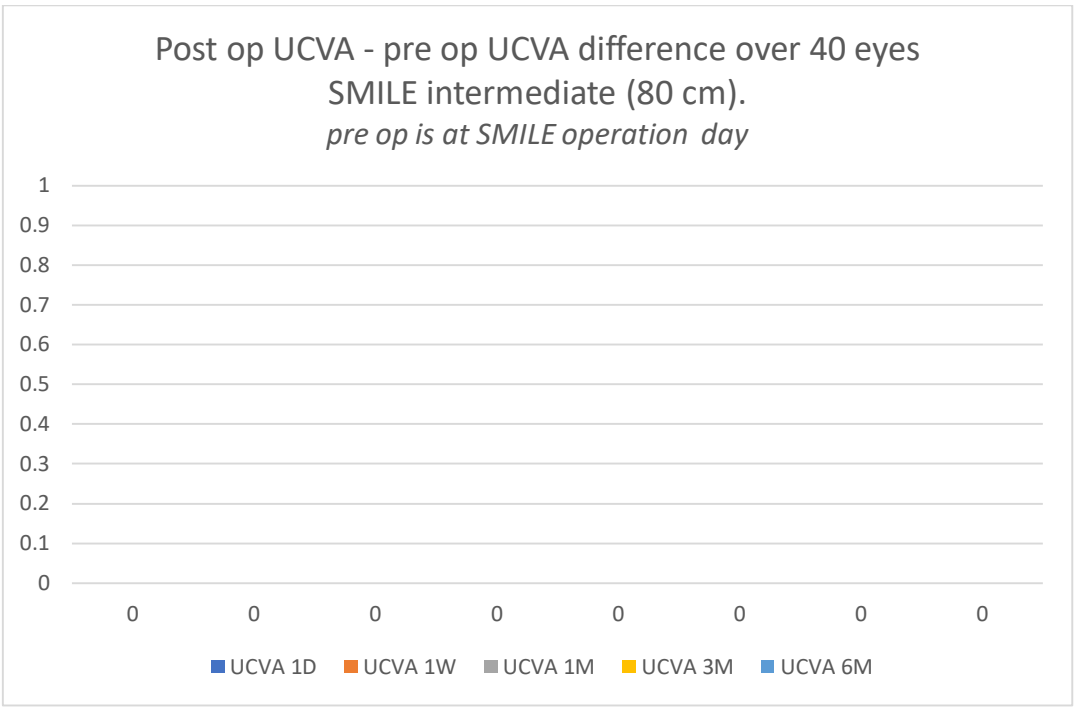

Post op UCVA - Pre op CDVA difference over 40 eyes
Toric trifocal lens intermediate (80 cm)
30
25
20
15
10
5
0
-0,4
-0,3
-0,2
-0,1
0
0,1
0,2
0,3
UCVA 1D
UCVA 1W
UCVA 1M
UCVA 3M
UCVA 6M

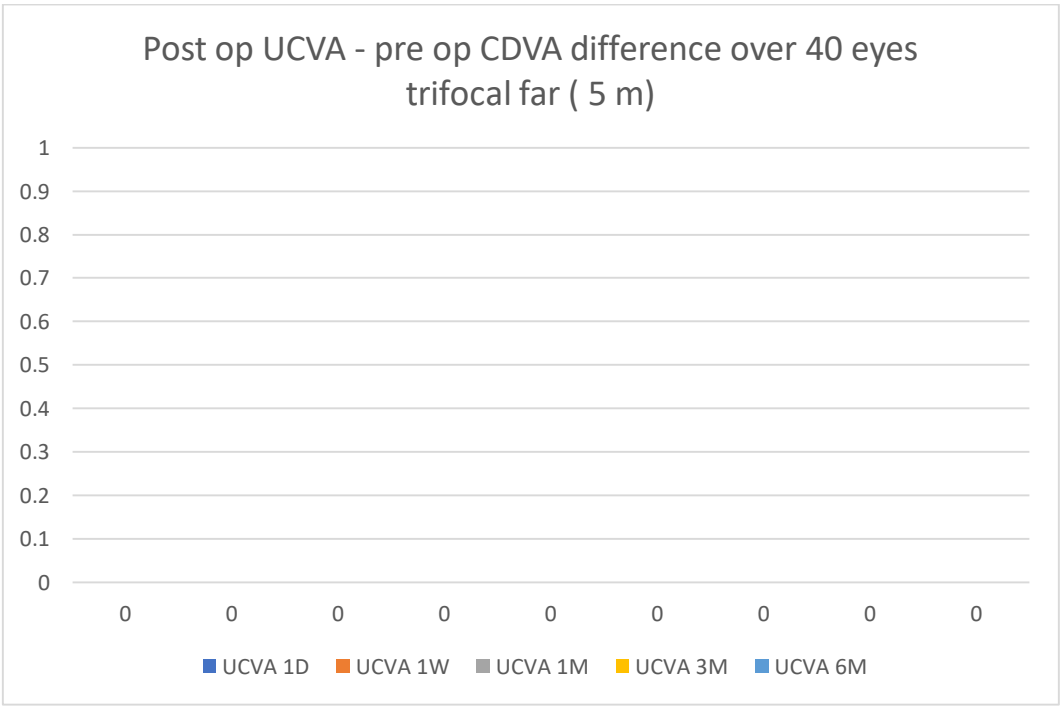

Post op UCVA - Pre op CDVA difference over 40 eyes
Toric trifocal lens far (5 m)
30
25
20
15
10
5
0
-0,4
-0,3
-0,2
-0,1
0
0,1
0,2
0,3
UCVA 1D
UCVA 1W
UCVA 1M
UCVA 3M
UCVA 6M

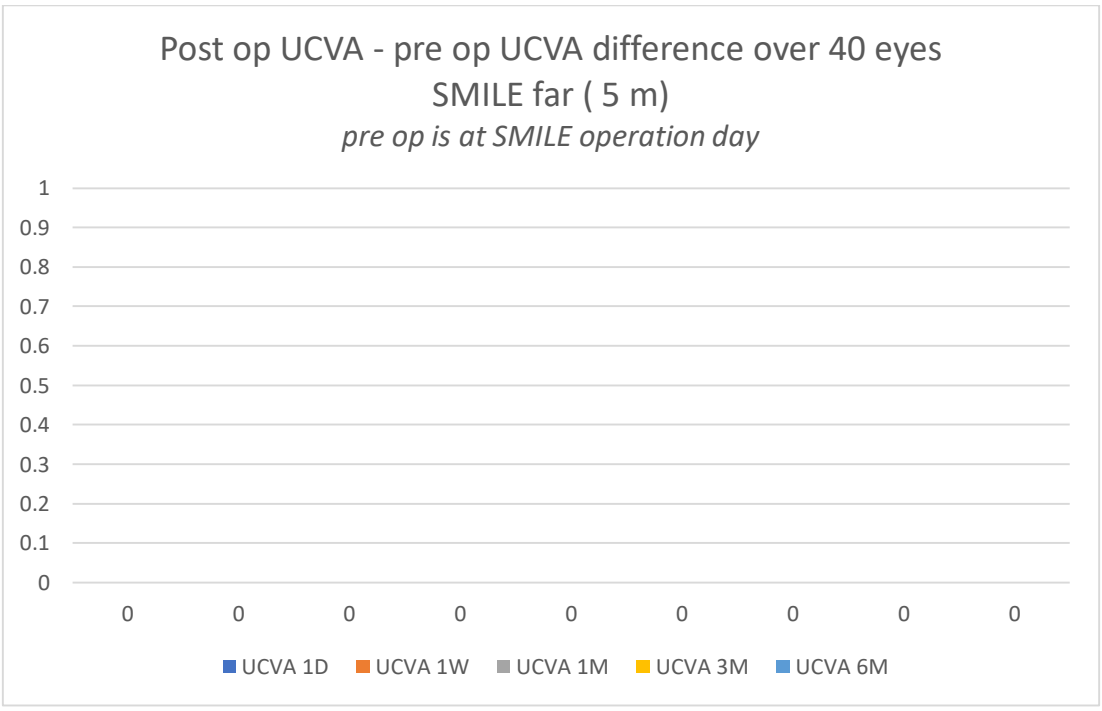

Post op UCVA - pre op CDVA difference over 40 eyes
trifocal near (40 cm)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0
0
0
0
0
0
0
0
UCVA 1D
UCVA 1W
UCVA 1M
UCVA 3M
UCVA 6M


Post op UCVA - pre op UCVA differences over 40 eyes
SMILE near (40 cm)
Pre op is at SMILE operation day
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0 0 0 0 0 0 0
UCVA 1D
UCVA 1W
UCVA 1M
UCVA 3M
UCVA 6M


Post op UCVA - pre op CDVA difference over 40 eyes
Trifocal intermediate (80 cm)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0 0 0 0 0 0 0
UCVA 1D
UCVA 1W
UCVA 1M
UCVA 3M
UCVA 6M


Post op UCVA - pre op UCVA difference over 40 eyes
SMILE intermediate (80 cm).
pre op is at SMILE operation day
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0 0 0 0 0 0 0
UCVA 1D
UCVA 1W
UCVA 1M
UCVA 3M
UCVA 6M


Post op UCVA - pre op CDVA difference over 40 eyes
trifocal far (5 m)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0 0 0 0 0 0 0 0
UCVA 1D
UCVA 1W
UCVA 1M
UCVA 3M
UCVA 6M



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