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# The Effect of Large Capsulorhexis (>7mm) on the Stability of Refraction Post Cataract Surgery

Ming Chen<sup>1\*</sup>

<sup>1</sup>University of Hawaii, USA, 55 S. Kukui St. C-109, Honolulu, Hawaii, USA 96813.

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## ABSTRACT

**Purpose:** To investigate if the larger capsulorhexis (7mm) is associated with a stable post-operative refraction with Acrysof IQ one-piece IOL (SN60WF, Alcon USA) implantation from 1month to 2 years after cataract surgery.

**Method:** Retrospective chart review was made on 31 eyes of 20 patients. All eyes had uncomplicated phacoemulsification by the author with 7mm capsulorhexis and Acrysof one-piece IOLIQ (SN60WF, Alcon USA) implantation between 4/2007 and 7/2008. IOL Master was used to select the IOL and target refraction was recorded. Refraction data by manifestation in spherical equivalent (SE) at one month, 3 month and 2 years were recorded and input to SPSS19.

**Result:** The mean refractions in spherical equivalent (SE) were statistically significant and excellent positively correlated among the preoperative target refraction (IOL master), one month post-op, three months post-op and two years post-op.  $P < 0.01$ , Pearson correlation coefficient:  $r > +0.9$  (95%CI 0.91 to 0.98)

**Conclusion:** The 7mm capsulorhexis with Acrysof one-piece IOLIQ (SN60WF, Alcon USA) implanted eyes demonstrated refractive stability from 1 month up to 2 years post operation.

*Keywords: Cataract surgery; phacoemulsification; capsulorhexis size; stability of refraction; pseudoexfoliation.*

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\*Corresponding author: Email: [mingchen@hawaii.rr.com](mailto:mingchen@hawaii.rr.com);

## **1. INTRODUCTION**

The performing of a small capsulorhexis before phacoemulsification during cataract surgery is popular among cataract surgeons. Many surgeons believe the small capsulorhexis (5 to 5.5 mm in diameter) can capture the optic of IOLs to prevent the IOL to move, thus may stabilize the refraction post operation. One study did demonstrate that cataract surgeries with the small capsulorhexis had less posterior capsule opacity compare to cases with large capsulorhexis post operation. However, for patients with Pseudoexfoliation syndrome and complicated cataract, phacoemulsification with a small capsulorhexis may be difficult to perform and complications such as posterior capsule rupture, nucleus drop and IOL dislocation may occur (Bayraktar et al., 2001). The incidence of Pseudoexfoliation syndrome (PXF) is from 0.6% to 19.5% (The Framingham Eye Study, Al-Shaer et al.). PXF is an age-related condition associated with a LOXL1 genetic defect in which fibrillar extracellular material builds up throughout the body (Belovay et al., 2010). Preoperative and intraoperative careful examination should be performed on those eyes with small pupil, shallow chamber and dandruff-like flakes on the lens. Some cases with mild Pseudoexfoliation syndrome cannot be detected preoperatively for surgeons to be cautious during surgery, therefore, larger than 7mm capsulorhexis may be safer for all the cataract surgery.

A safe phacoemulsification is considered to be able not only to protect the cornea but also can protect the zonules and the posterior capsule. Iris plane phacoemulsification with large capsulorhexis combine with a proper amount of viscoelastic injection between nucleus, posterior capsule and cornea can protects posterior capsule and corneal endothelium.

Large capsulorhexis can enhance the Iris plane phacoemulsification and also cause less capsular contraction. Through an electronic search in the literature using the key words of capsulorhexis size and stability of refraction, there was lack of evidence to prove the size of capsulorhexis can affect the stability of refraction. This study intends to demonstrate that with Acrysof one-piece IOLIQ (SN60WF, Alcon USA) implantation and large capsulorhexis (7mm) in phacoemulsification will not cause instability of the refraction.

## **2. METHODS**

A retrospective chart review was conducted on 31 eyes of 20 patients. Patients' ages were between 53 to 86 years. There were 11 females and 9 males. All eyes underwent uncomplicated phacoemulsification by a single surgeon with 7mm capsulorhexis and Acrysof one-piece IOL IQ (SN60WF, Alcon USA) implantation. Between 4/2007 and 7/2008, 31 eyes met the inclusion criteria and were randomly selected from 320 cases that had the same procedure done during the same period of time for the study. Those eyes had LRI (Limbal Relaxation Incision) were excluded for the study. Eyes that underwent LRI were excluded due to the potential instability of postoperative refraction.

The refraction data of preoperative target, one month, three months and two years respectively were converted to spherical equivalent (SE) and input to SPSS 19 (version 19.0.1; SPSS Inc., Chicago, IL, USA) for correlation study to compare the mean.

### 3. RESULTS

The mean refractions in spherical equivalent (SE) were statistically significant and excellent positively correlated among the preoperative target refraction (IOL master), one month post-op, three months post-op and two years post-op.

Pre-op target mean refraction -0.51D, one month -0.59 D, three months -0.50D and two years -0.51D.

Pearson correlation (Table 1) was performed on the main data cohort using SPSS software (version 19.0.1; SPSS Inc., Chicago, IL, USA).

**Table 1. Pearson correlation coefficient:  $r > +0.9$  (0.91 to 0.98) (P= 0.00)**

Correlations		Target	b	d	c
Target	Pearson Correlation	1	.905**	.938**	.914**
	Sig. (2-tailed)		.000	.000	.000
	N	31	31	31	31
b	Pearson Correlation	.905**	1	.962**	.974**
	Sig. (2-tailed)	.000		.000	.000
	N	31	31	31	31
d	Pearson Correlation	.938**	.962**	1	.984**
	Sig. (2-tailed)	.000	.000		.000
	N	31	31	31	31
c	Pearson Correlation	.914**	.974**	.984**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	31	31	31	31

\*\* Correlation is significant  $P < 0.01$ ;

Target = pre-operative prediction of post-operative mean refraction,

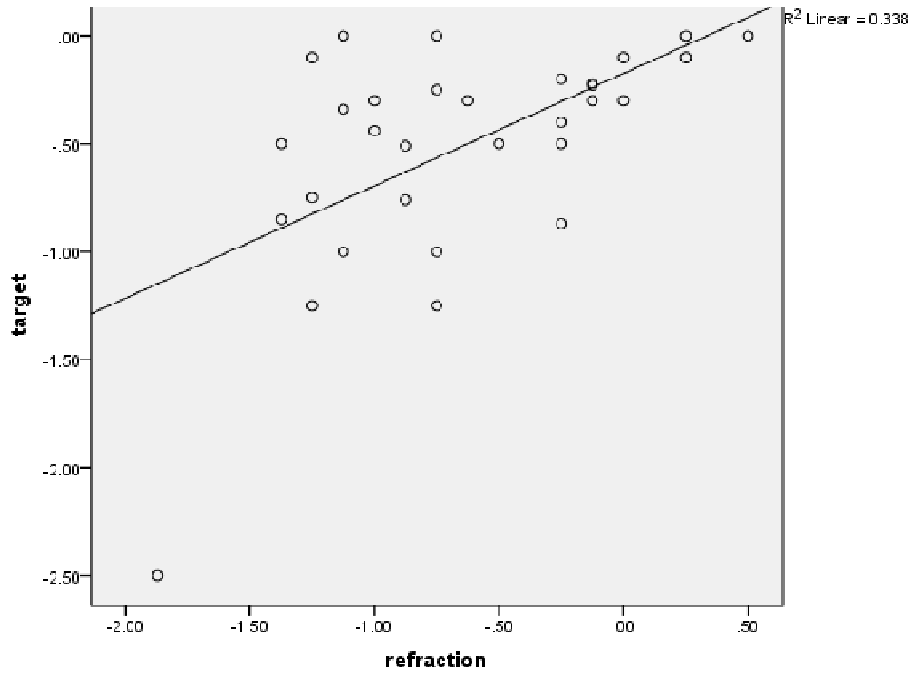
b= at one month refraction,

c= at three month refraction,

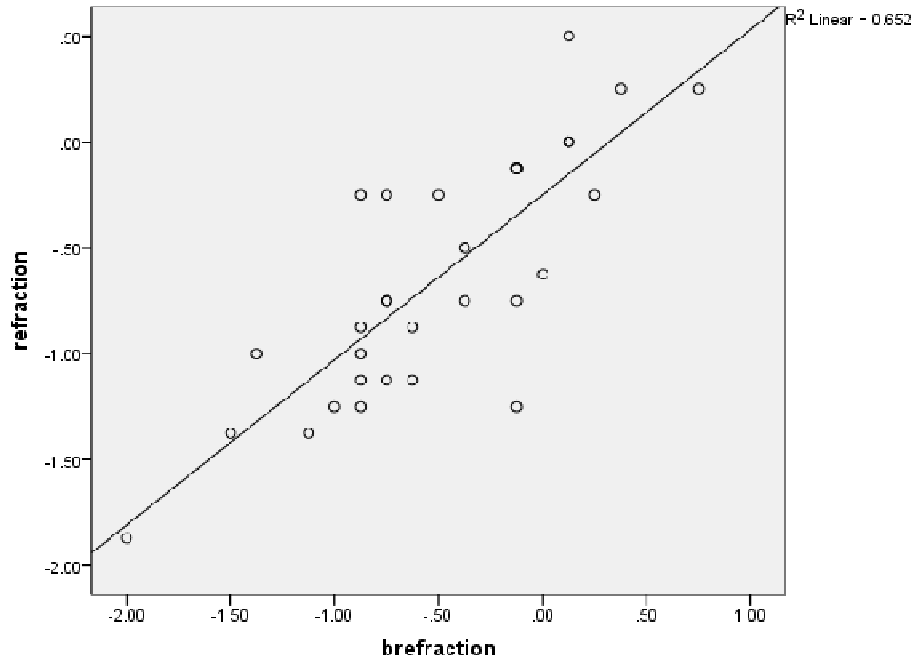
d= at two years refraction;

$P < 0.001$  (There was an excellent positive correlation between pre-op target, one month, three months and two years)

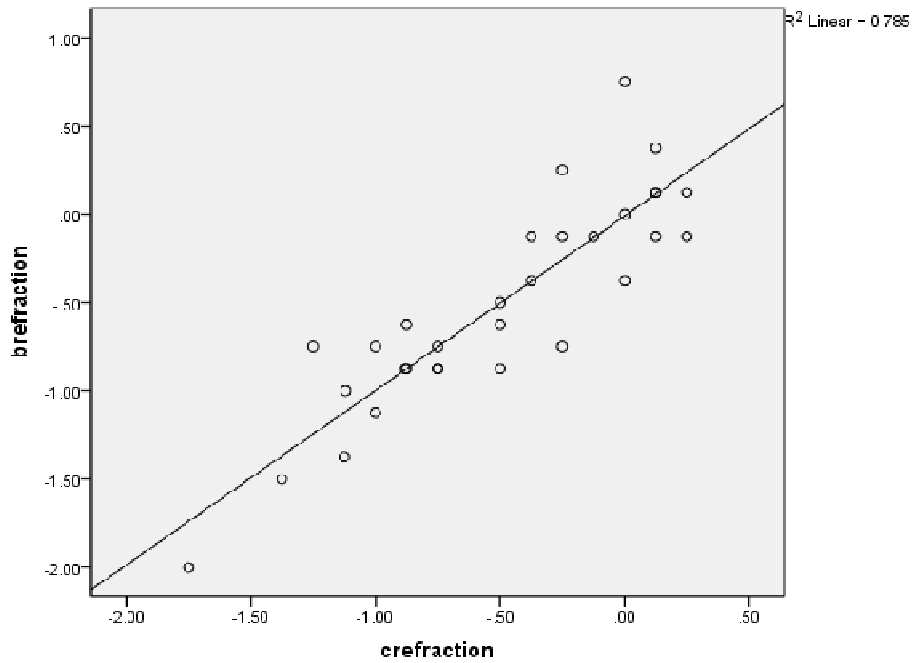
The pre-op prediction refraction in diopter of SE was not highly correlated to one week post-op refraction in diopter of SE ( $R^2=0.338$ ).



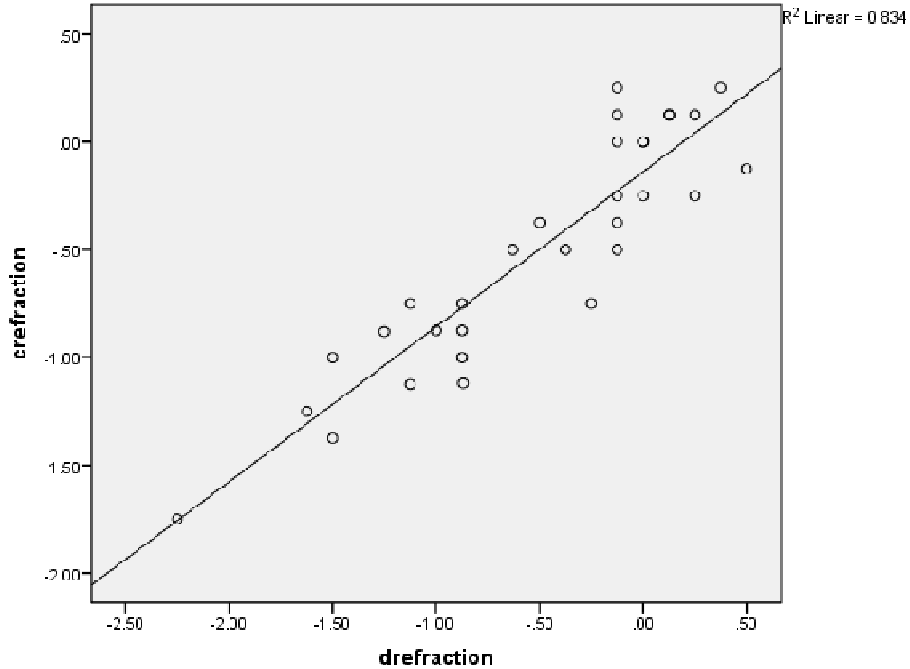
**Fig. 1. Correlation between pre-op prediction and 1 week refraction.**  
Y= target= Pre-op prediction of refraction in diopter of SE (Spherical equivalent) by IOL Master,  
X= refraction= 1week post-op refraction in diopter of SE



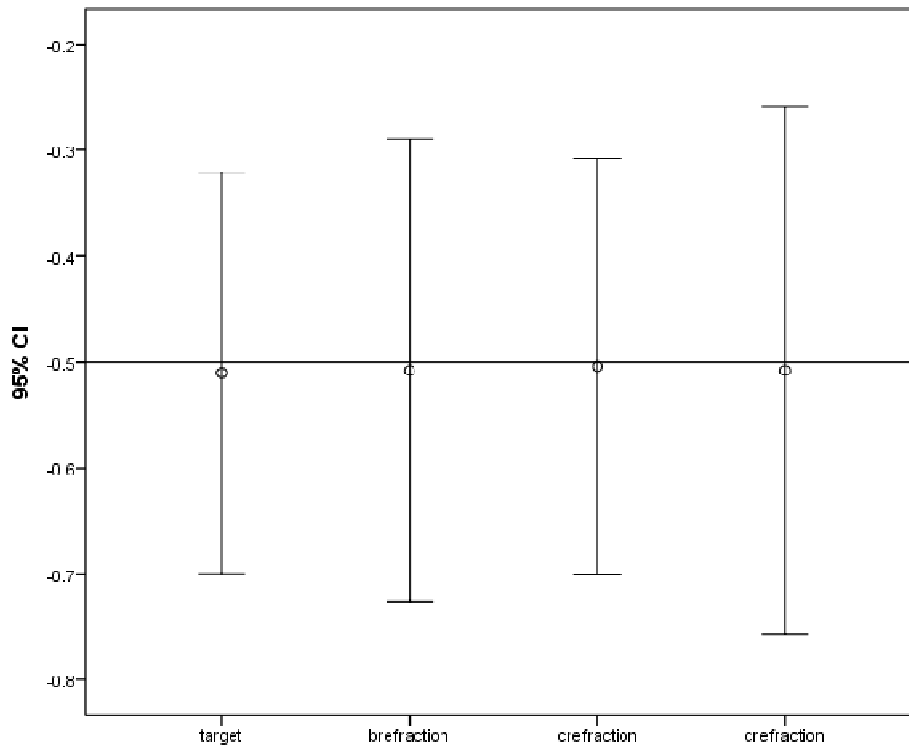
**Fig. 2. Correlation between 1 week refraction and 1 month refraction.**  
Y= refraction= 1 week post-op refraction in diopter of SE, X= brefraction= 1 month post-op refraction in diopter of SE. It was good correlated ( $R^2=0.652$ )



**Fig. 3. Correlation between 1 month refraction and 3 month refraction.**  
*Y= brefraction= 1 month post-op refraction in diopter of SE, X= crefraction= 3 months post-op refraction in diopter of SE. it was highly correlated(  $R^2=0.785$ )*



**Fig. 4. Correlation between 3 month refraction and 2 years refraction.**  
*Y=crefraction= 3 months post-op refraction in diopter of SE, X=drefraction= 2 years post-op refraction in diopter of SE. It was excellently correlated (  $R^2=0.834$ )*



**Fig. 5. Plot of means with 95% confidence interval.**  
*All four mean refractions were similar statistically*

#### 4. DISCUSSION

Pearson correlation coefficient:  $r > +0.9$  (95% CI: 0.91 to 0.98) ( $P < 0.01$ ), according to Fink (Fink, 1995). There is an excellent positive correlation in mean refraction between pre-op target, one month, three months and two years. Plot of means with 95% confidence interval also showed that all four mean refractions were similar statistically. It indicated that large capsulorhexis (>7mm) demonstrated refractive stable from one month through two years.

There are reports of increased incidence of capsular phimosis and late in the bag IOL dislocation (Trivedi et al., 2002). It can be due to endocapsular phacoemulsification or too small capsulorhexis (Gimble et al., 2005). Steps should be taken to minimize forces on the zonules during surgery. Nevertheless, it is possible that sometimes patients show no signs of preoperative zonular pathology. Weak zonules can be further weakened by allowing large shifts in anterior chamber depth, rotational forces and downward and nasal pressure during nuclear sculpting and lens insertion. While capsule can be more flaccid and easier to damage during phacoemulsification or aspiration, vitreous can present through weak zonules and the nucleus may sink.

Eyes with zonular pathology from PXF and complicated cataract can cause various complications during cataract surgery. Vitrectomy usually is necessary to be performed by less experience general ophthalmologist with less efficient vitrector. Either sutured IOL or

anterior chamber IOL implantation for these complicated cases may increase the risk of endophthalmitis, glaucoma, and cystoid macula edema.

For those hidden PXF and those complicated cataract, iris plane phacoemulsification with large capsulorhexis (7mm) may be safer than small capsulorhexis endocapsular phacoemulsification, because the former is more zonules-friendly.

The result of this study is important because it can alleviate the concerns of most surgeons where larger than 6mm capsulorhexis can cause postoperative refractive instability. Therefore, larger than 7mm capsulorhexis can be safely utilized in risky cataract patients to prevent complication and even used routinely. In further literature review, a similar study demonstrated distance corrected near vision is better with a large continuous curvilinear capsulorhexis with less overlapping of the optic (Vargas et al., 2005). Additionally, another similar study showed that there was no correlation between the magnitude of the IOL movement and the capsulorhexis diameter (Muftuoglu et al., 2005). However, the possibility of the increasing opacification of posterior capsule with larger capsulorhexis should be considered in one of the related study (Aykan et al., 2003).

## **5. CONCLUSION**

The 7mm capsulorhexis with Acrysof one-piece IOL IQ (SN60WF, Alcon USA) implanted eyes demonstrated refractive stable from one month to two years after cataract surgery. Since this is a retrospective non-control study, future prospective randomized control study to evaluate the effect of the size of capsulorhexis on post-operative refraction is validated.

## **ACKNOWLEDGEMENTS**

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## **COMPETING INTERESTS**

Author has declared that no competing interests exist.

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