

# Scanning Electron Microscopic Characteristics of Manually Loaded and Preloaded Foldable IOLs

Mahmoud Rateb MD

Associate Professor and Consultant Ophthalmologist

**I have no financial interest**

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# Introduction

- Surface alterations of optical surface of foldable acrylic Intraocular lenses (IOL)s during the process of folding, cartridge engagement and unfolding were reported by multiple authors, (Erie et al.,2010)(Strauss et al.,2012)
- These alteration in optical surface were also reported to play a role in increase surface roughness and hence the growth of LECs (Lens Epithelial Cells) in vitro.(Tanaka et al.,2005)



# Introduction

- Preloaded Intraocular lenses (IOL)s were introduced in the market with offerings from its manufacturers with excellent preservation of the optic material, and protection of the lens material of any damage during handling by the nurse or the surgeon associated with reusable instruments.
- In this experimental study, we evaluated surface characteristics of manually loaded IOLs and preloaded IOLs after in vitro injection, regarding optic surface quality, using Scanning Electron Microscope (SEM)

# Materials and Methods

3 IOLs  
of Power  
+ 4,22,29

HYDROPHOBIC

i-Stream ISP60GL  
(md tech,italy)

3 IOLs  
of power  
+4,22,29D

HYDROPHILIC

Versario  
Classic Aspheric  
(Croma,Austria)

3 IOLs  
of power  
+ 4,22,29

PRELOADED  
HYDROPHOBIC

i-Stream ISP60  
(md tech,italy)

3 IOLs  
of power  
+ 4,22,29 D

PRELOADED  
HYDROPHILIC

Barret  
(Croma,Austria)

# Materials and Methods

**one IOL of each group were taken directly from its packaging with no folding/unfolding**



◀ **DIRECT STUDY**

**Each IOL was folded using reusable sterile titanium forceps to the its cartridge and injector**

◀ **Non-  
PRELOADED**

**Each IOL was folded and prepared for injection following instructions of its manufacturer**

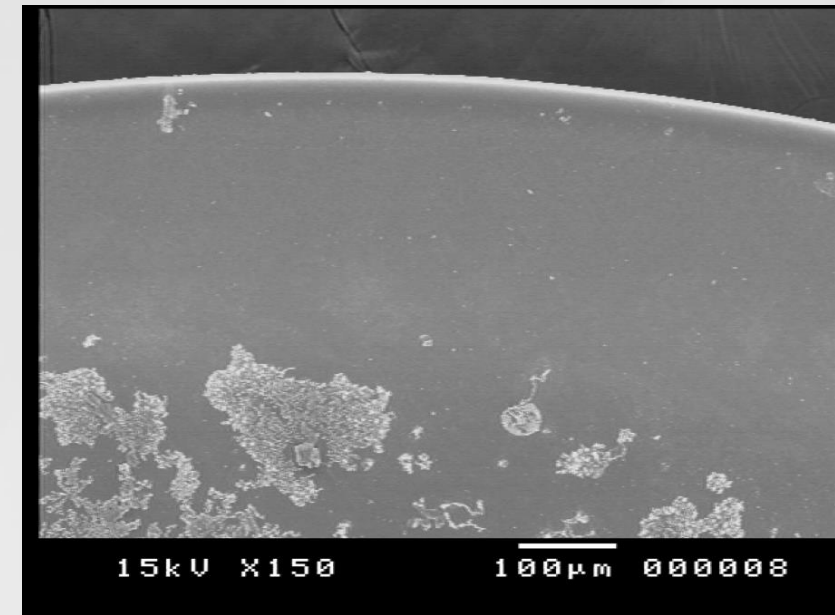
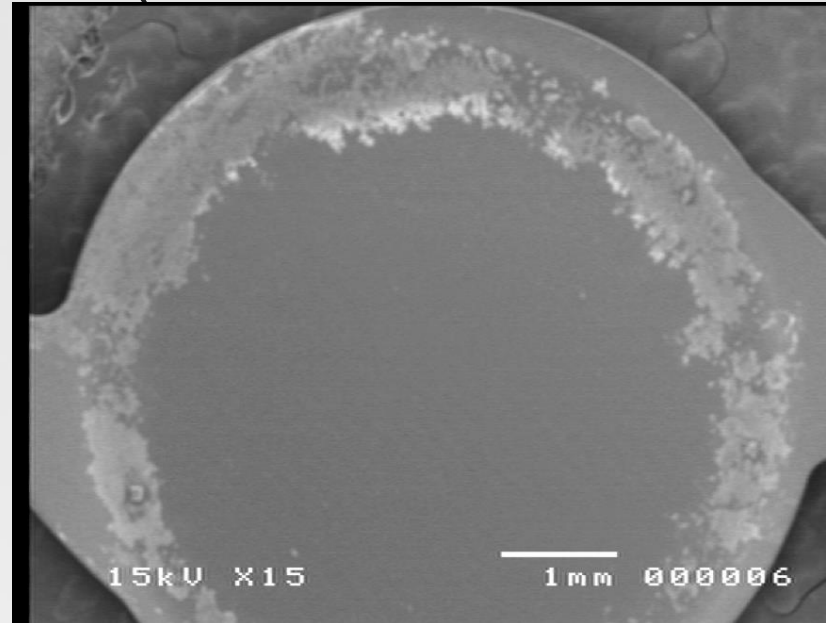
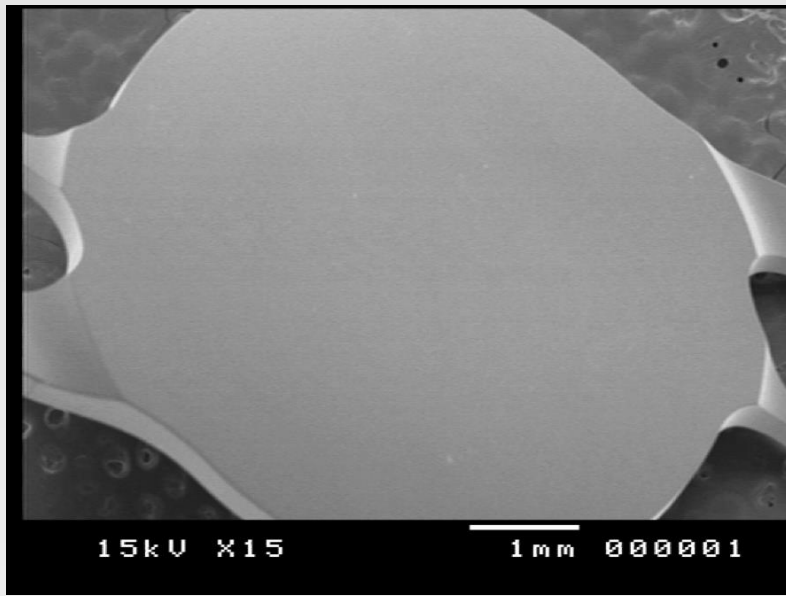
◀ **PRELOADED**



# Methods



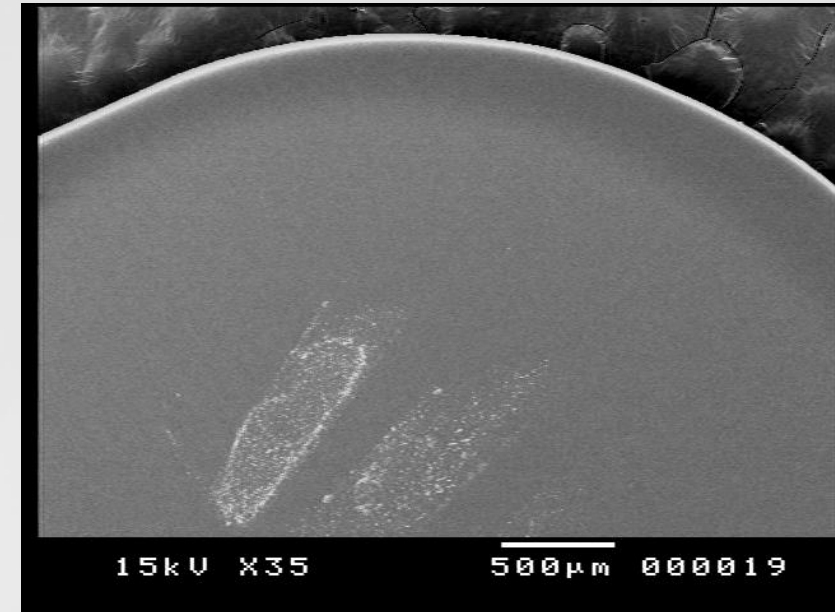
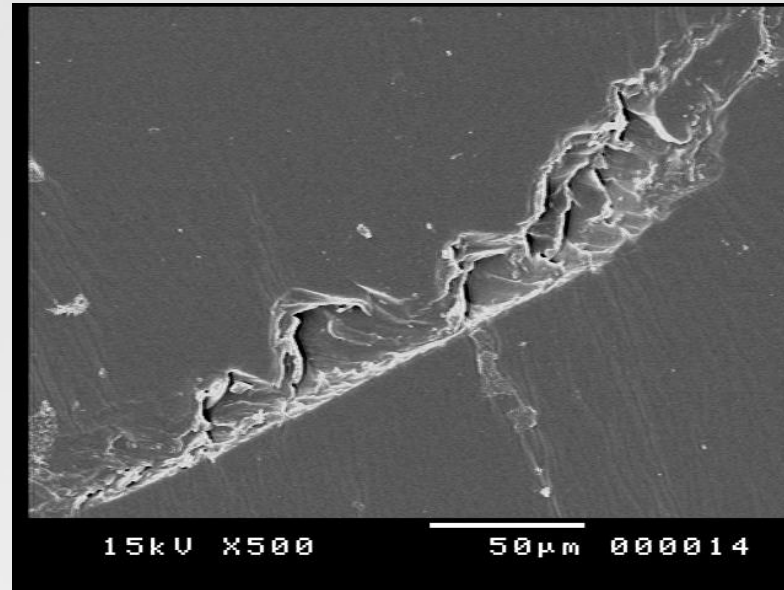
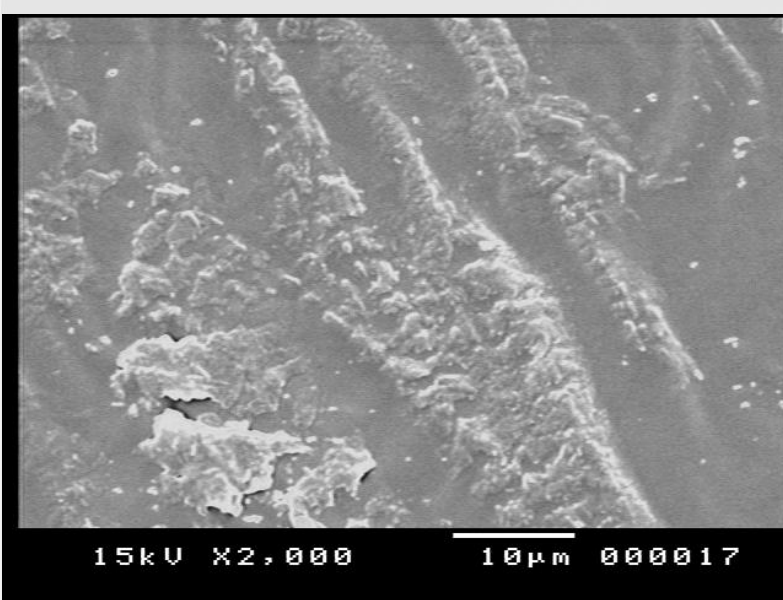
# Results of SEM (direct scan or non-injected IOLs)



- **Non-preloaded IOLs** :Showed smooth and homogeneous optic surface before folding ,The edge finish of all optics showed no evidence of ridges or molding flashes
- **Preloaded IOLs**: showed high quality finished optical surface in one hydrophilic IOLs and showed deposits on the optical surface of the other IOL (hydrophobic)
- Higher Magnification of the deposits

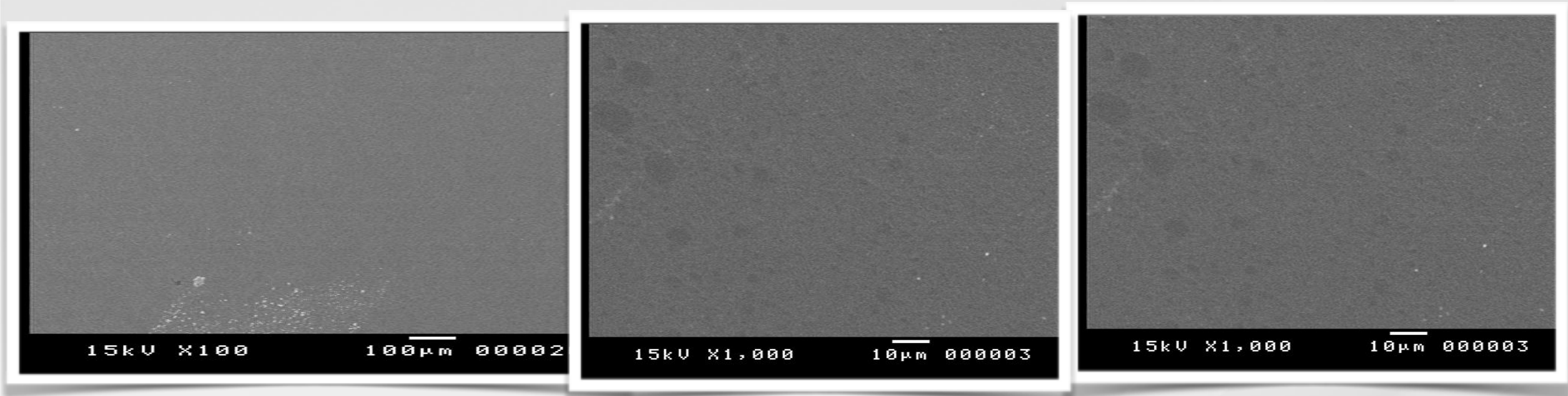


# Results of SEM (injected non-preloaded)



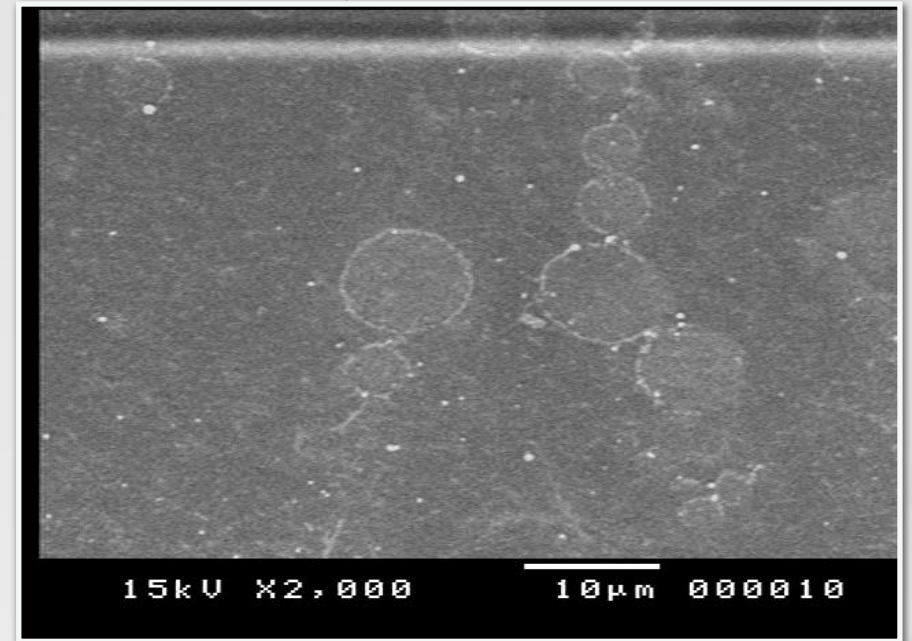
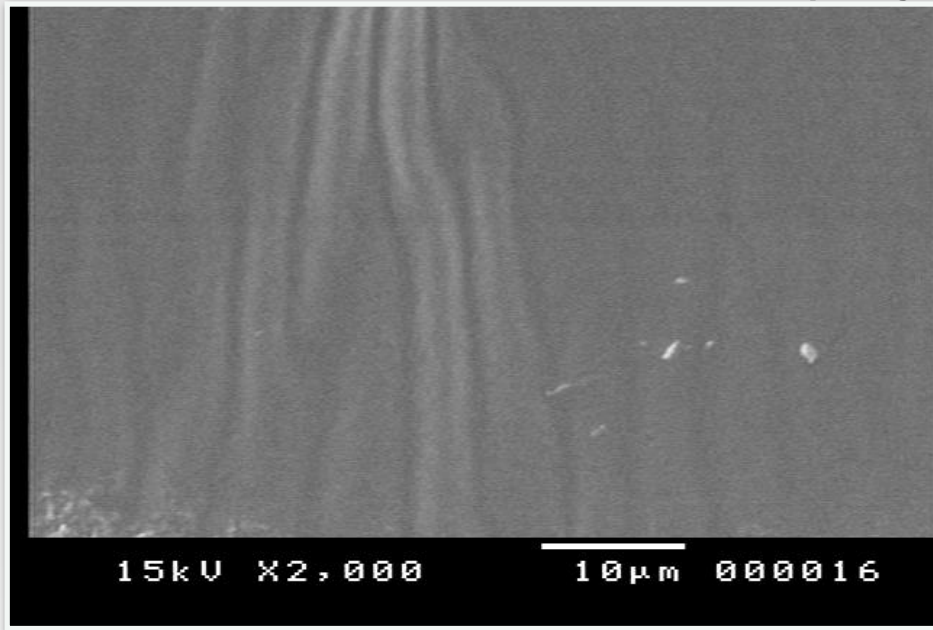
- On highest magnification these scratches represented actual damages to the lens surface material
- two IOLs were of the hydrophobic type. Marks were even deeper and more profound on higher magnification representing actual damage to the smooth optical surface.
- Three of the IOL examined(75%) , there were identifiable marks on the optical surface in lower magnification (scratch marks and deposits)

# Results of SEM (Injected preloaded)



- Two IOLs shows no identifiable marks with clean polished optical surface

# Results of SEM (Injected preloaded)



- Two IOLs, one showed **wrinkled** optical surface the other IOL showed some deposits over the optical surface of the lens, both were of the hydrophobic type



# Discussion

- Surface properties are important for IOL safety, particularly for an IOL's long-term biocompatibility.

The degree of roughness of the IOL surface contributes to cell adhesion. (Tanaka et al.,2006)

- This may affect the visual results because of the possibility of inflammatory cell adhesion on the altered surface of the implanted IOL to enhance PCO.
- The presence of surface alteration on optical surface of IOLs were studied using SEM and Atomic Force Microscope (AFM) by multiple authors, these alterations occurs during manipulation , folding and injection. (Erie et al.,2010)(Strauss et al.,2012)(Oshika and Shiokawa,1996)

# Discussion

- **Jay et al.**, found that these scratches would stay up to 72 hours and reported absence of these scratches with if we use OVD during manipulation. In our study, we found that these surface alterations occurs even with the concurrent use of OVD, the higher magnification of SEM showed that these alteration could represent an actual damage to the optical surface of the lens.





# Discussion

- On the other hand, preloaded IOLs were expected to show better optical quality after delivery due to the absence of manipulation, on SEM examination there were no major surface alterations with hydrophilic type. However, the hydrophobic type showed surface alteration in both injected (wrinkles and deposits) and non-injected IOLs(deposits)

# Discussion

- The presence of deeper and aggressive scratches over the optical surface of hydrophobic IOLs depends on **transition temperature of the material ( $T_g$ )** which means that some of the IOLs is more rigid in the operating room temperature and manipulation with the help of OVD (which is usually stored in refrigerator) would even make it more rigid and vulnerable to damage during manipulation

# Discussion

- Friction between the IOL and the injector is the main cause of wrinkles and surface alterations (Usui and Tanaka, 2015). We found the same finding in preloaded IOLs. The surface quality of preloaded IOLs, is determined by the improved manufacturing process, especially enhancement of the automated loading and proper choose of gliding agent to the cartridge material. However, some gliding agent such as the polypropylene, appears on the surface of the cartridge and deposited on the surface of the IOLs. This finding appears to be more common with hydrophobic preloaded IOLs.

# Conclusion

- Some **Preloaded IOL** systems have lower stress on the surface lens optic and optic/haptic junction. This may offer less damage to the optical surface especially with unexperienced surgeons.
- Theoretically, this may **offer lower PCO rates**. However, the impact on visual quality needs further assessment.



# Thank You

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