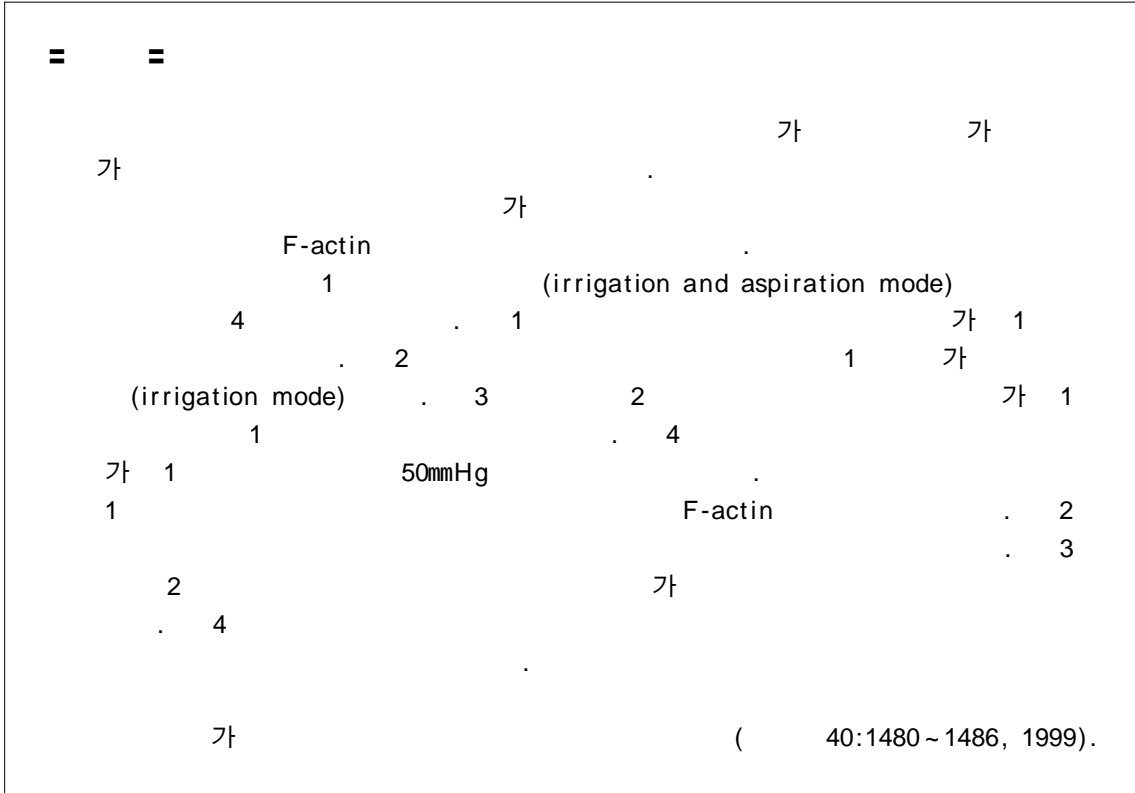


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## Effects of Air Bubble on the Corneal Endothelium

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During intraocular surgery including cataract, air bubbles occasionally enter the anterior chamber during irrigation. The influences of these air bubbles on the cornea endothelium, however, have yet to be known. The purpose of this study is to investigate the effects of bubbles on the rabbit corneal endothelium during irrigation and aspiration mode in experimental phacoemulsification.

After anesthesia, the anterior chamber was irrigated and aspirated for 1 minute with balanced salt solution. The rabbits were then randomly divided into 4 groups.

In group 1, corneal endothelial irrigation and aspiration were performed without air bubbles for 1 minute. In group 2, corneal endothelial irrigation was performed in the presence of air bubbles in the anterior chamber for 1 minute. In group 3, corneal endothelial irrigation and aspiration were performed in the presence of air bubbles in the anterior chamber for 1 minute. In group 4, corneal endothelial irrigation was performed with silicone oil at 50mmHg pressure in the presence of air bubbles in the anterior chamber for 1 minute.

In group 1, the cornea endothelial cells showed normal F-actin without cell damage. In group 2, a ring shaped endothelial cell destruction area adjacent to the border was found along the margin of the air bubble. In group 3, similar ring-shaped lesion found in group 2 were observed but with more extensive cell destruction. In group 4, a partial number of cell to cell separation was found without endothelial cell destruction.

In conclusion, air bubbles in the anterior chamber during irrigation with balanced salt solution showed destructive changes in rabbit corneal endothelial cell(J Korean Ophthalmol Soc 40:1480~1486, 1999).

Key Words : Air bubble, Balanced salt solution, Corneal endothelium, F-actin, Phacoemulsification

가 ) ,

가

4.3% 9%

가 , 가

F-actin

(balanced salt solution)

(irrigation

and aspiration)

5,11)

가

가

(phaco tip)

F-actin

가

가

가

Beesley 2)

가

1.

2 3kg

가

8

16

. Craig 3)

Monson 4)

가 pentobarbital sodium(Entobar , ) 100mg/kg 가

(punctate)

가

. Kim

(Universal , Alcon Surgical Inc, Irvine, California, USA)

(BSS , Alcon Surgical Inc., Fort

Worth, TX, USA) 가 1 (50 Ml/min)

5)

85cm

Van Horn 6)

Lee 7)

가

가

4

, Eiferman

Wilkins<sup>8)</sup>

1

1

24

(irrigation and aspiration mode)

(peau d'orange appear-

, 2

nace)

, Leibowitz 9)

Tsubota

1

가

(irrigation

10)

가

mode)

가

가

가

. 3

2

가

1

1

(irrigation and aspiration mode)

가

가

가

. 4

1 (Adato Sil-ol 1000, Muenchen, Germany) 50mmHg

, Filter DM 510(excitation, 450 490nm, barrier, 520nm) Olympus 12,13)

, 가

10% 0.5cc

1

2. F-actin

F-actin

(Fig. 1).

2 3mm  
90 10%  
8.5mm  
(forceps)

가  
2  
가

8 Nitrobenzoxadiazole-phallicidin (1.64 × 10<sup>-4</sup> mol/l, Molecular Probes Inc., Eugene, Oregon, U.S.A) 37 30 0.01M (phosphate-buffered-saline solution ; PBS, pH 7.2), PBS glycerol 1:1

F-actin 10~30

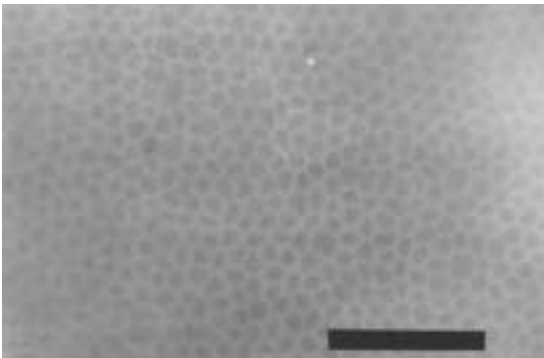


Fig. 1. Nitrobenzoxadiazole(NBD)-phallicidin stained F-actin fibers of the normal rabbit corneal endothelium. No F-actin changes are observed in corneas after irrigation and aspiration of BSS without exposure to air bubble in vivo(nitrobenzoxadiazole-phallicidin, ×200, bar=50μm).

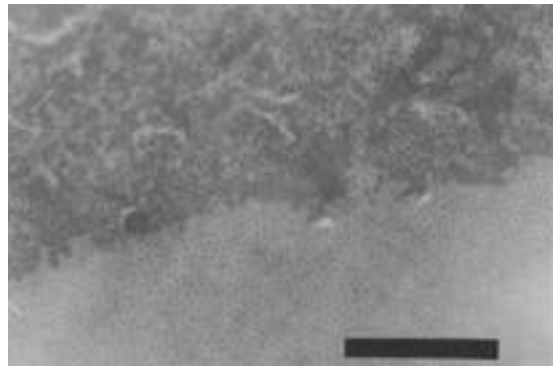


Fig. 2. Rabbit corneas following 1 minute of irrigation and then 1-minute exposure to air bubble in vivo while a phacoemulsification unit was irrigating the anterior chamber. The normal sheet of endothelium is disrupted by a large area of endothelial cell loss showing ring-shaped lesion (ring shaped lesion could not be photographed because of the technical difficulty here); the area has irregular borders and no F-actin staining. There are many pieces of cell debris on the surface of endothelial cell loss(nitrobenzoxadiazole-phallicidin, ×100, bar=100μm).

가

F-

(Fig. 6).

actin 가 (Fig. 2,3).

가

3

가

2

2

(ring shape)

F-actin

Kim <sup>5)</sup>

perfu-

sion 가

2

가

가

Kim

(Fig. 4,5).

<sup>5)</sup> 가

가

73 dyne/cm <sup>14)</sup>

4

가

2

F-actin

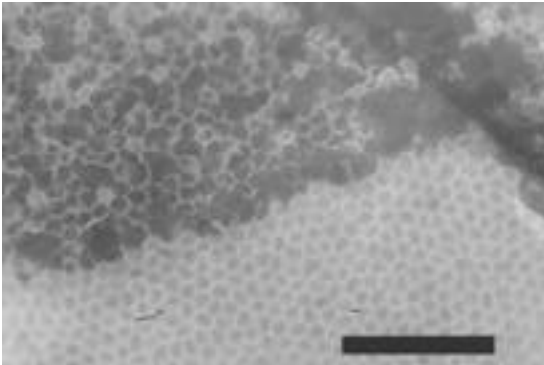


Fig. 3. High magnification of the Fig. 2. The normal sheet of endothelium is disrupted by a large area of endothelial cell loss showing ring-shaped lesion (ring shaped lesion could not be photographed because of the technical difficulty); the area has irregular borders and no F-actin staining. There are many pieces of cell debris on the surface of endothelial cell loss (nitrobenzoxadiazole-phallicidin,  $\times 200$ , bar=50 $\mu\text{m}$ ).

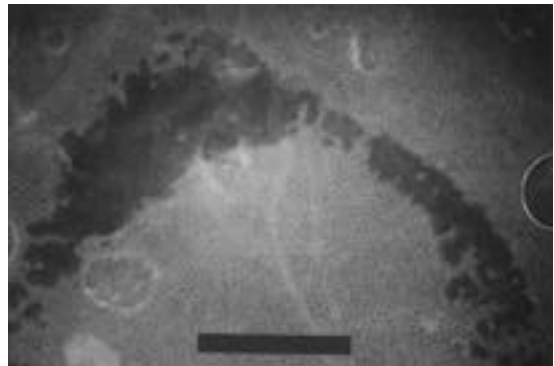


Fig. 4. Rabbit corneas following 1 minute of irrigation and then 1-minute exposure to air bubble in vivo while a phacoemulsification unit was irrigating and aspirating the anterior chamber. The normal sheet of endothelium is disrupted by a ring shaped band of endothelial cell loss; the band has irregular borders and no F-actin staining. This band was part of a ring that circled the region of the cornea adjacent to the air bubble (nitrobenzoxadiazole-phallicidin,  $\times 100$ , bar=100 $\mu\text{m}$ ).

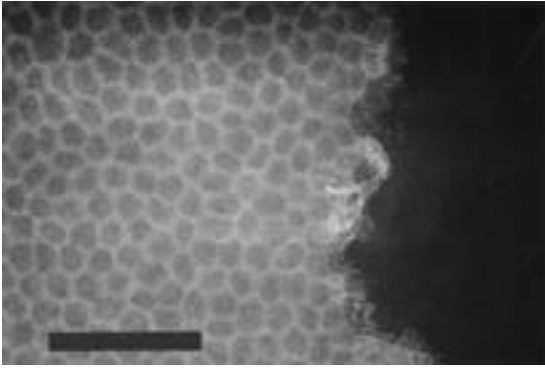


Fig. 5. High magnification of the Fig. 4. The normal sheet of endothelium is disrupted by a band of endothelial cell loss; the band has irregular borders and no F-actin staining(nitrobenzoxadiazole-phallicidin,  $\times 400$ , bar= $25\mu\text{m}$ ).

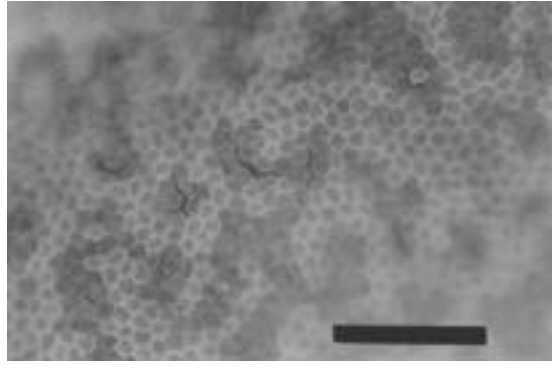


Fig. 6. Rabbit corneas following 1 minute of irrigation and then 1-minute exposure to air bubble in vivo while silicone oil was injected and was aspirated in the anterior chamber. The intercellular junctions between the several endothelial cells became splitted and interspace of those endothelial cells are wider than usual. These abnormalities are distributed randomly and showed no interrelation with the bubble margin. Even though the cells adjacent to the intercellular junctional split show the decreased F-actin density, no cells are lost in number and in shape (nitrobenzoxadiazole-phallicidin,  $\times 200$ , bar= $50\mu\text{m}$ ).

3  
 . 3  
 .  
 20 dyne/cm<sup>15)</sup>  
 1000 cps  
 (4 )  
 . , ( )가  
 . , , 가  
 가  
 ,  
 ( ; 20 dyne/cm)  
 ( ; 47 dyne/  
 cm)<sup>16)</sup>  
 .  
 가  
 가  
 (1000 cps) 가  
 .  
 가

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