

## Air Bubbles at the Tip of an Endolaser Probe during Microincision Vitrectomy Surgery

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### Abstract

**Objective:** To investigate possible factors that could cause air bubbles at the tip of an endolaser probe and to describe a technique to remove air bubbles during microincision vitrectomy surgery (MIVS).

**Methods:** Thirty patients (30 eyes) had 23-gauge MIVS, and endolaser photocoagulation with an endolaser probe was performed to complete panretinal photocoagulation. The primary outcome measure was the frequency for the incidence of air bubbles. In addition, experiments were performed in a bottle filled with a balanced salt solution (BSS) to evaluate possible contributing factors.

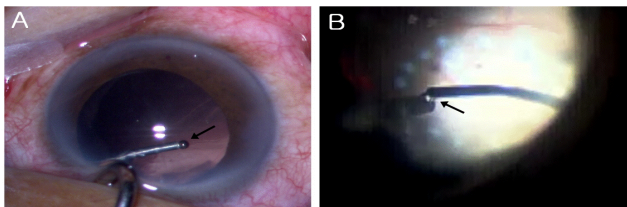
**Results:** The frequency for the incidence of air bubbles was  $3.8 \pm 2.1$  times/500 shots. In the bottle filled with BSS, at 59°F, the mean frequency of air bubbles from ethylene oxide-sterilized endolaser probes ( $2.8 \pm 1.5$  times per 500 shots) was significantly higher than that from new probes ( $0.8 \pm 0.8$  times per 500 shots) (Mann-Whitney U-test,  $P=0.032$ ). The result was related to neither the temperature of the BSS nor the use of illumination from the illuminated endolaser ( $P>0.05$ , respectively). The air bubbles were removed by slapping the tip of the endolaser probe on the illuminator or by taking the endolaser probe out of the trocar.

**Conclusion:** The incidence of air bubbles arising from the tip of the endolaser probe was related to the use of an ethylene oxide-sterilized endolaser probe. The effective removal of these air bubbles can be achieved by slapping the tip of the endolaser probe on the illuminator or taking the endolaser probe out of the trocar.

**Keywords:** Air bubbles; Endolaser photocoagulation; Endolaser probe; Ethylene oxide; Microincision vitrectomy surgery

### Introduction

Recently, the authors found air bubbles at the tip of an endolaser probe during endolaser photocoagulation in 23-gauge microincision vitrectomy surgery (MIVS) (Figure 1A).



**Figure 1:** (A) Air bubble at the tip of the endolaser probe during microincision vitrectomy surgery. (B) Removal of the air bubble by tapping the tip of the endolaser probe onto the illuminator.

These air bubbles obscured the operative field and interfered with the aiming of the laser and most importantly, attenuated the effect of

endolaser photocoagulation. The authors investigated possible contributing factors that could cause air bubbles and herein, describe a technique for the removal of air bubbles from the tip of an endolaser probe.

### Methods

Air bubbles were identified by retrospective analysis of surgical video recordings in all thirty cases of 23-gauge MIVS with panretinal photocoagulation (PRP) for proliferative diabetic retinopathy, performed between April 2013 and January 2014. The surgical procedure was performed using 23-gauge MIVS with the Accurus Vitrectomy System (Alcon Laboratories, Fort Worth, TX, USA). Balanced salt solution (BSS plus<sup>®</sup>; Alcon Laboratories, Fort Worth, TX, USA) was kept at 46.4°F in a refrigerator before use as an infusion fluid. A 23-gauge stiletto blade (45° angle; BD Medical-Ophthalmic Systems, Franklin Lakes, NJ) was inserted at a 15° to 30° angle through the conjunctiva, sclera, and pars plana 4.0 mm from the limbus. A microcannula was then inserted through the conjunctival incision and into the scleral tunnel using a specially designed blunt inserter (DORC). In patients with cataracts dense enough to interfere with the intraoperative visibility, phacoemulsification was done with an Infiniti Vision System (Alcon Laboratories). A core vitrectomy and creation of a posterior vitreous detachment were performed under a wide-angle viewing system or contact lens viewing system. After removal of the

proliferating membrane and excision of the posterior hyaloids membrane, vitreous and preretinal hemorrhages were cleared up with a back flush needle. Peripheral vitrectomy and vitreous base shaving were performed. Endolaser photocoagulation with a Purepoint® laser and illuminated flex curved laser probe (Alcon Laboratories, Fort Worth, TX, USA) was performed to complete panretinal photocoagulation (PRP) up to the anterior retina. The endolaser probes were new or reused after sterilization with ethylene oxide (EtO) gas. At the end of the surgery, the trocars were removed, and the conjunctiva was repositioned to cover the sclerotomy sites.

Experiments were performed in a bottle filled with BSS to evaluate possible contributing factors including the temperature of BSS and the use of illumination on the illuminated endolaser probes, which might affect the frequency for the incidence of air bubbles. Furthermore, we

compared the incidence of air bubbles between ten new endolaser probes and ten reused probes that had been EtO-sterilized.

## Results

A retrospective analysis of the surgical video recordings in all thirty cases showed that the average number of endolaser photocoagulation spots was  $936.2 \pm 481.7$  shots per operation (range, 403-2001) and the frequency for the incidence of air bubbles was  $3.8 \pm 2.1$  times per 500 shots.

Experiments in a bottle filled with BSS showed that there was no significant difference among the different temperatures of BSS with and without illumination ( $P > 0.05$ , respectively) (Table 1).

	Illumination on (n=5)			P value	Illumination off (n=5)			P value
	41°F	59°F	77°F		41°F	59°F	77°F	
Temp (°F)	41°F	59°F	77°F	0.785**	41°F	59°F	77°F	0.834**
Incidence of air bubbles* (counts/500 shots)	$3.2 \pm 0.8$	$2.8 \pm 1.6$	$3.0 \pm 1.2$		$2.8 \pm 1.2$	$2.8 \pm 1.5$	$3.2 \pm 1.5$	

Temp: Temperature.  
 \* The incidence of air bubbles was calculated as counts for 500 shots of endolaser photocoagulation with the Purepoint® Laser.  
 \*\* P Kruskal-Wallis test.

**Table 1:** The incidence of air bubbles at the tip of the endolaser probe according to the temperature of the balanced salt solution and the use of illumination on the illuminated endolaser probe.

At 59°F, the mean frequency of air bubbles from the EtO-sterilized endolaser probes ( $2.8 \pm 1.5$  times per 500 shots) was significantly higher than that from the new probes ( $0.8 \pm 0.8$  times per 500 shots) (Mann-Whitney U-test,  $P = 0.032$ ).

## Discussion

In vitreoretinal surgery, lasers are most commonly used to treat retinal detachments, retinal tears, or neovascularization. Especially, PRP during vitreoretinal surgery is important and effective for patients with PDR [1,2] but also a time-consuming procedure. Thus, the problem with endolaser photocoagulation is that it could extend the operating time and also change the surgical outcomes.

The optimal storage temperature of BSS is between 35.6°F and 77°F according to the manufacturer's recommendations. In our clinics, BSS was kept at 46.4°F prior to vitrectomy. Thus, we compared the frequency of air bubbles at temperatures of 41°F, 59°F, and 77°F with reused illuminated endolaser probes. However, there was no significant difference among the different temperature of BSS.

Air bubbles might also occur as a result of the use of EtO gas during the sterilization process of the endolaser probes [3,4]. Thus, we compared the occurrence of air bubbles between ten new endolaser probes and ten reused probes that had been EtO-sterilized. At 59°F, the mean frequency of air bubbles from the EtO-sterilized endolaser probes was significantly higher than that from the new probes. The above results suggest that air bubbles arising from the tip of the endolaser probe could be related to using EtO-sterilized endolaser probes. However, from a practical perspective, it is costly to use a new endolaser probe for every vitrectomy. Therefore, it was necessary to identify an effective way to remove the air bubbles from the probe without compromising the surgical procedure. Air bubbles are not

easily removed by just swirling the endolaser probe. Instead, tapping the tip of the endolaser probe on the illuminator can effectively remove the air bubbles (Figure 1B). In addition, taking the endolaser probe out of the trocar could remove the air bubbles. However, it could disturb the surgical view.

There are several limitations in the present study. Because the data from the surgeries were based on video recordings, unfortunately, the exact kind of probe, new or sterilized with EtO, was not recorded. Further evaluation of more cases and a comparison of the various temperatures in the current study would provide more additive information to help understand this finding of air bubbles.

In conclusion, it is recommended not to reuse EtO-sterilized endolaser probes to avoid air bubbles during endolaser photocoagulation. Alternatively, gently tapping the tip of the endolaser probe onto the illuminator can effectively remove air bubbles without compromising visibility during surgery.

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## References

1. Diabetic Retinopathy Vitrectomy Study Group (1998) Early vitrectomy for severe proliferative diabetic retinopathy in eyes with useful vision. Clinical application of results of a randomized trial-Diabetic Retinopathy Vitrectomy Study Report 5. *The Diabetic Retinopathy Vitrectomy Study Research Group. Ophthalmology* 95: 1321-1334.
2. The Diabetic Retinopathy Vitrectomy Study Research Group (1990) Early vitrectomy for severe vitreous hemorrhage in diabetic retinopathy.

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- Four-year results of a randomized trial: Diabetic Retinopathy Vitrectomy Study Report 5. *Arch Ophthalmol* 108: 958-964.
  3. Lucas AD, Merritt K, Hitchins VM, et al (2003) Residual ethylene oxide in medical devices and device material. *J Biomed Mater Res B Appl Biomater* 66: 548-552.
  4. Mendes GC, Brandao TR, Silva CL (2007) Ethylene oxide sterilization of medical devices: a review. *AM J infect control* 35: 574-581.