Aipril/2014

The 40th American Society of Cataract and Refractive Surgery

Temperature alteration in the aqueous humor by viscoelastic materials during phacoemulsification

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(Authors have no financial interest)

Purpose

To evaluate temperature of anterior chamber solutions when using several ophthalmic viscosurgical devices (OVDs) during phacoemulsification.

Methods

Materials : Porcine Eyes（each group : n=5）

The anterior chamber was filled with one of the OVDs.

Methods :

①The surgery was performed via a superior 2.4 mm corneal incision.

②The thermometer probe was inserted from the 3 o'clock port and was secured in front of the ultrasound tip.

③Phacoemulsification was performed ***without irrigation and aspiration in the anterior chamber.***

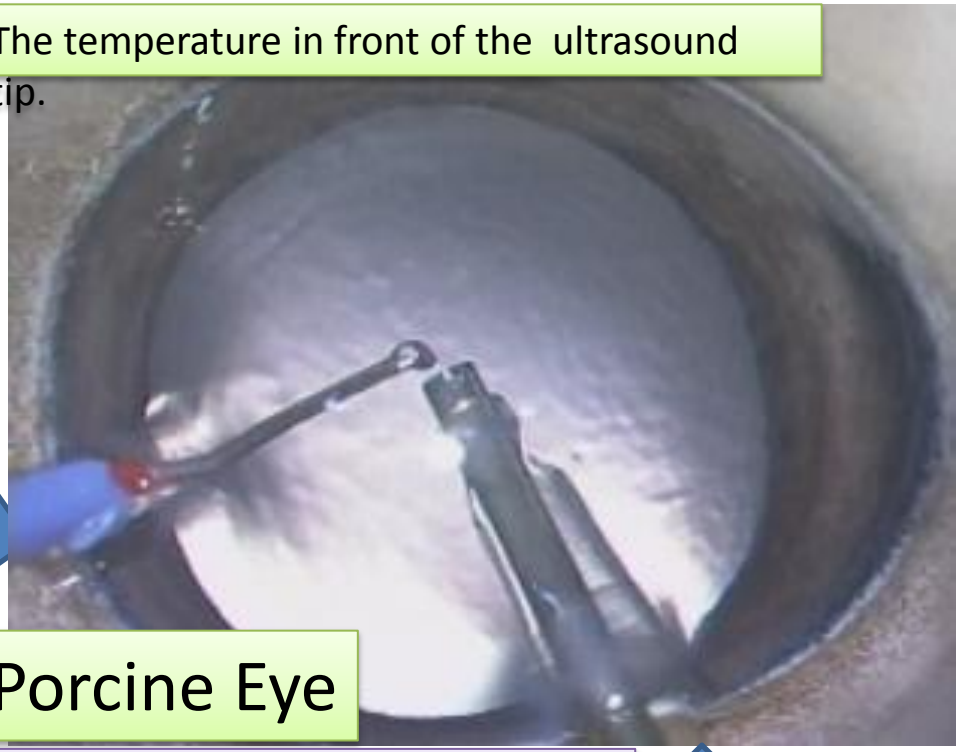
④Temperature changes were measured and recorded for 1 minute.

Temperature was measured using the SE-305 (Thermo DataLogger,Center Technology Corporation).

The system of temperature measurement in the aqueous humor

Data Record

The temperature in front of the ultrasound tip.



Porcine Eye

(filled with OVD in the anterior chamber)

Thermometer

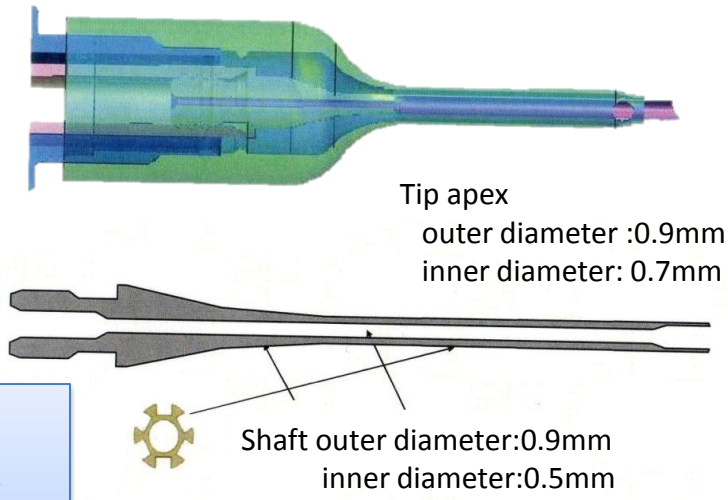
Phaco Machine

OVDs

Sodium hyaluronate 3% Sodium chondroitin sulfate 4%	Sodium hyaluronate 1.65% Sodium chondroitin sulfate 4%	Sodium hyaluronate 1%	Sodium hyaluronate 2.3%
			
Viscoat®	DisCoVisc®	Healon®	Healon V®

Setting of phacoemulsification

Ultrasound tip and sleeve

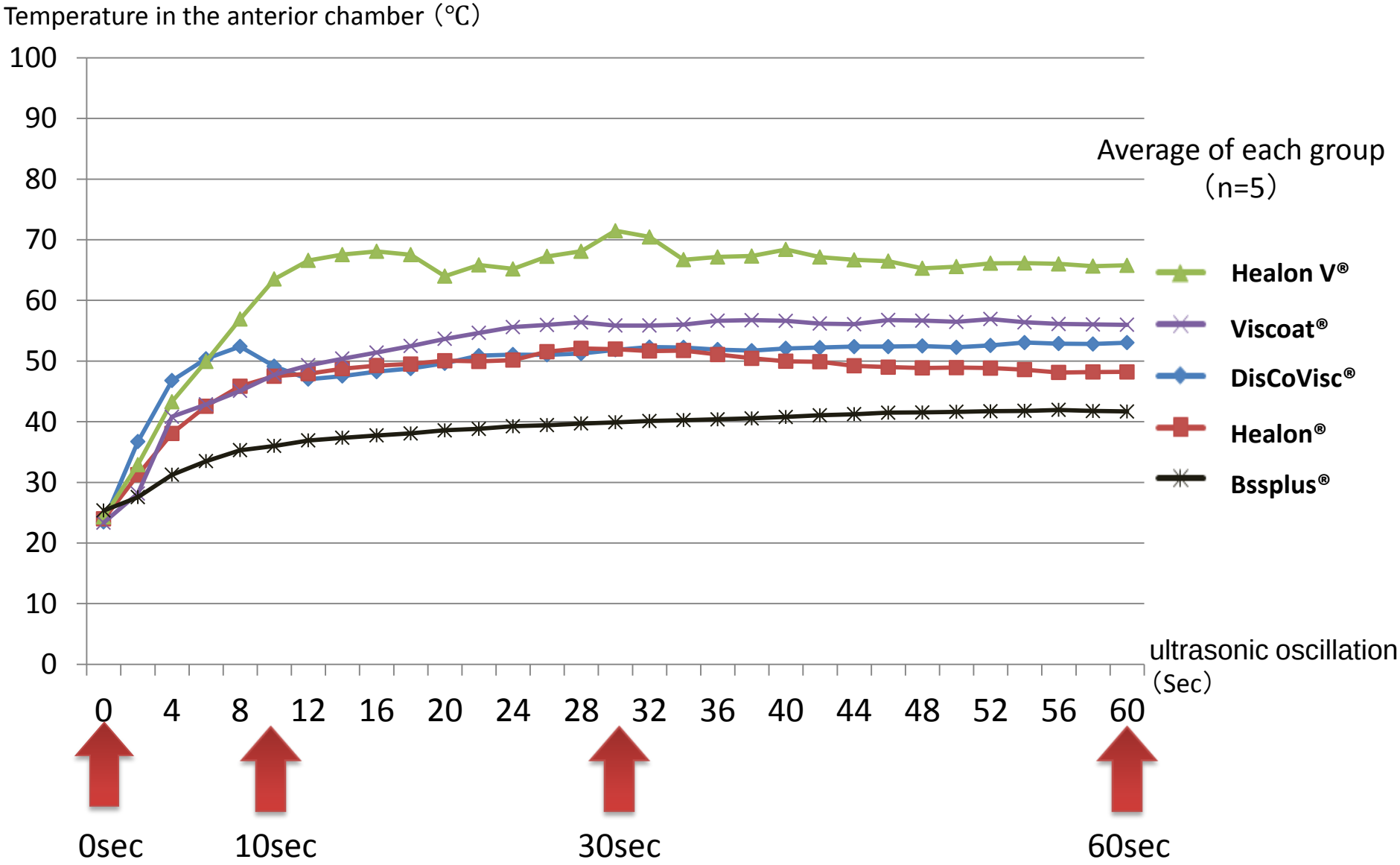


Aspiration set 18cc/min
Vacuum pressure 50mmHg
Bottle height 50cm
Ultrasound power 100%

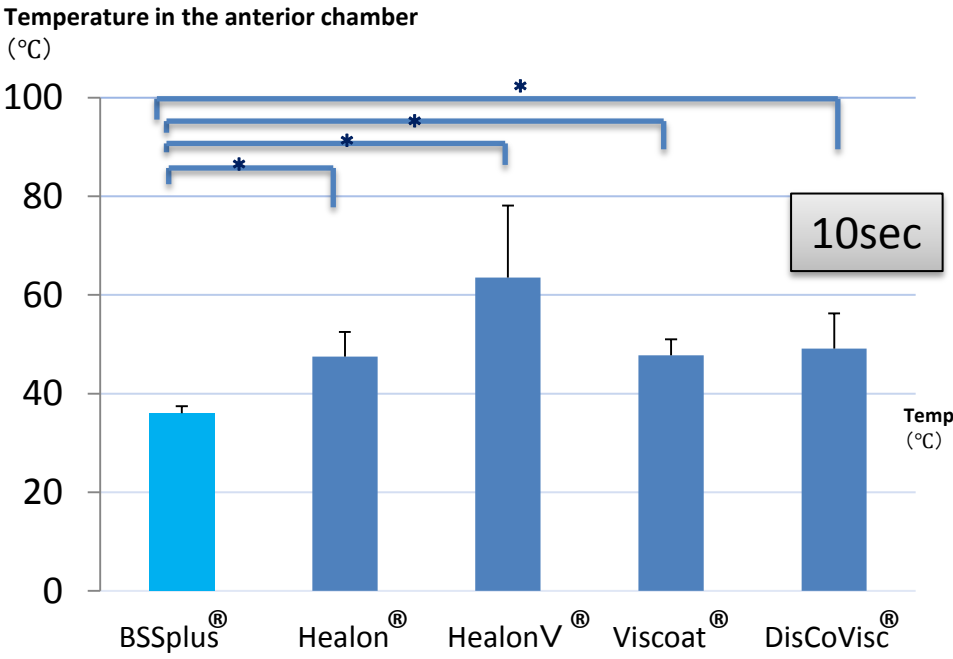
Bausch&Lomb, Stellaris ®(Peristaltic Pump system）
Commonly used settings and ultrasound tip were determned.

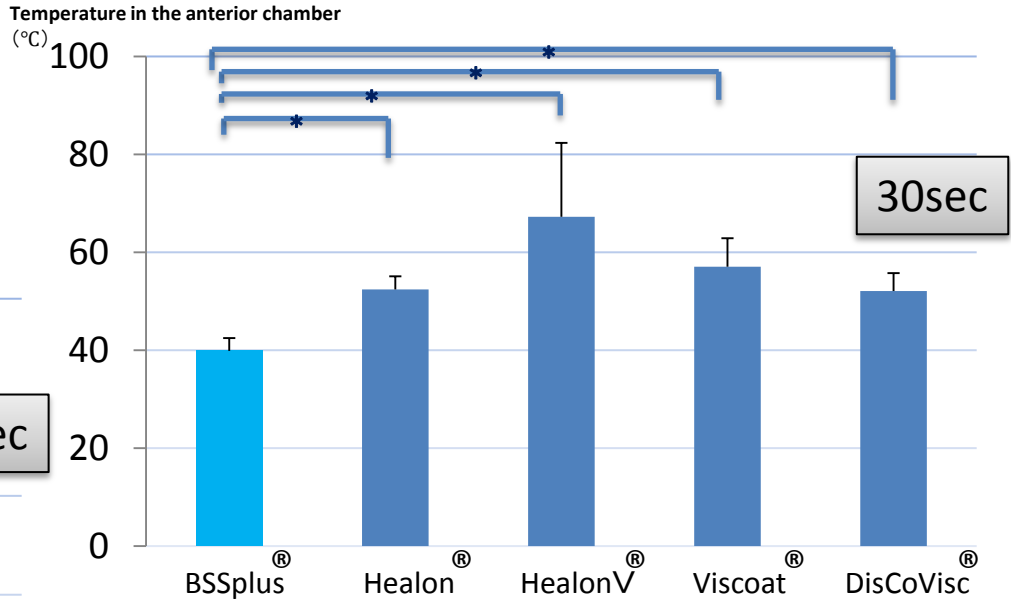
Results

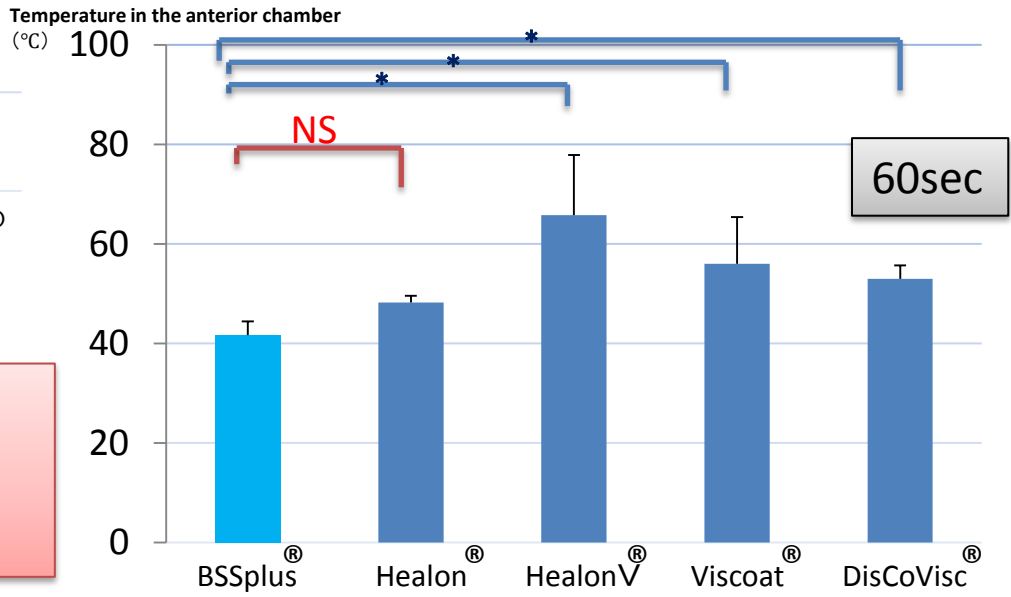
Temperature alteration in the anterior chamber



Effects of each OVDs (1).



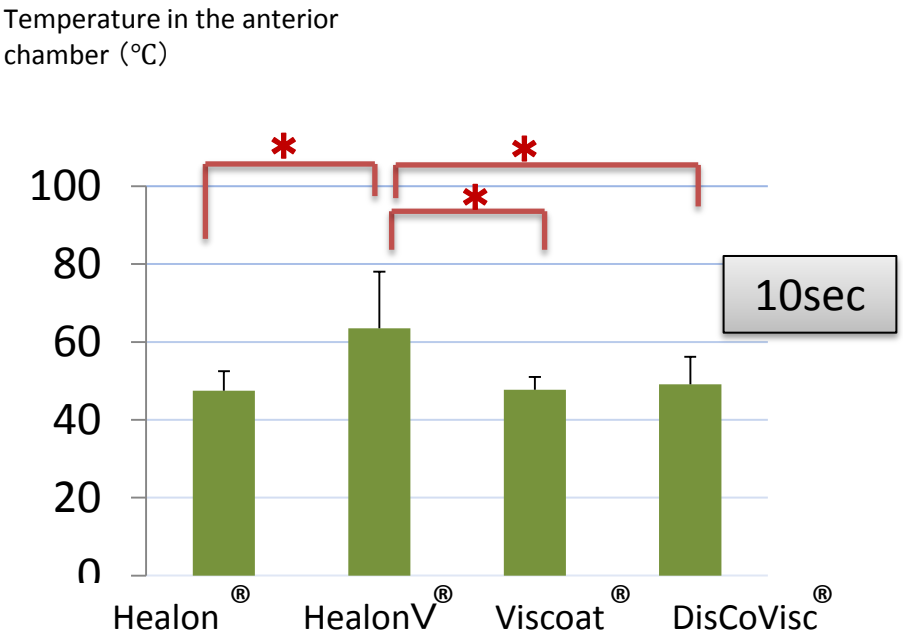


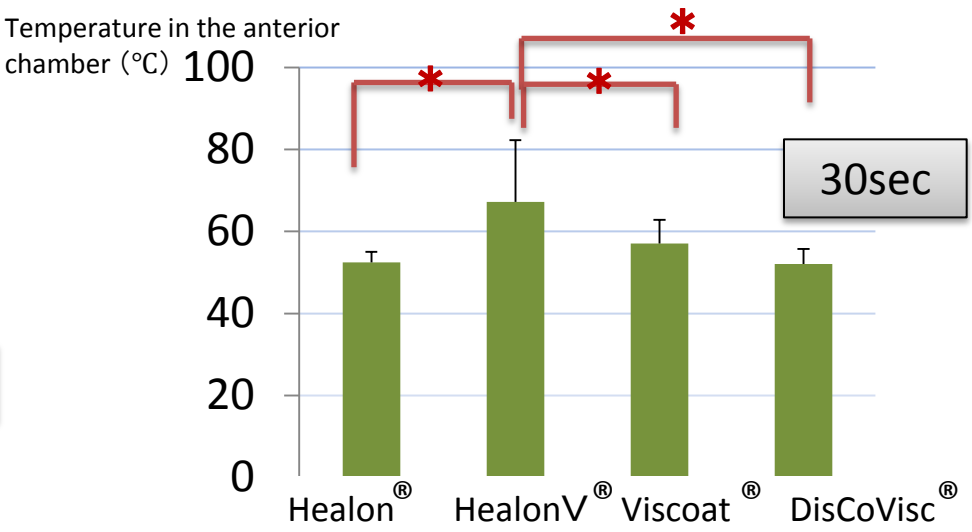


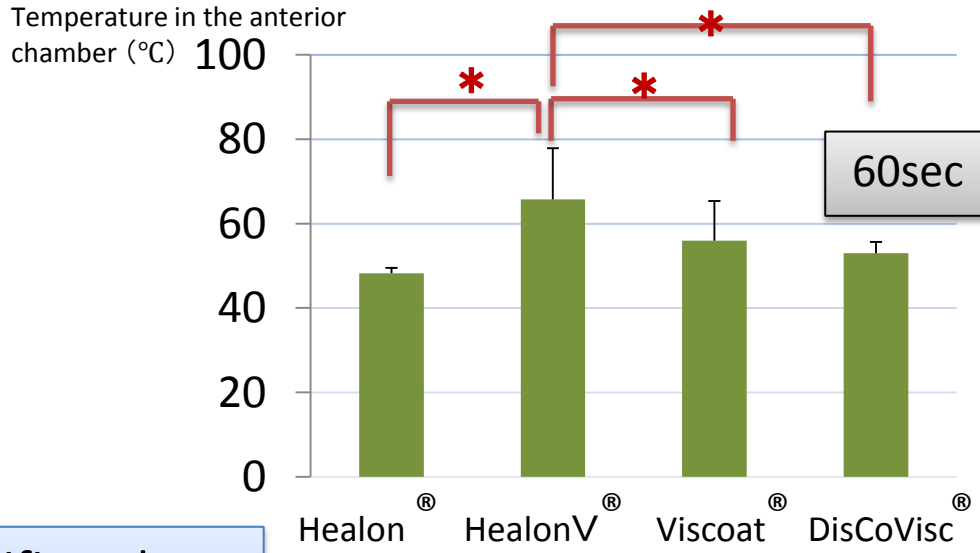
At 60 seconds, the temperature with all OVDs except Healon® was significantly higher than BSSplus.

Dunnett-test, ＊: $p<0.05$

Effects of each OVDs (2).







The temperature with Healonv® was significantly higher than others.

SNK-test, ＊ : $p<0.05$

Discussion

While the OVDs remained sufficiently in front of the tip, the anterior chamber temperature rapidly rose during ultrasound oscillation.

→ It was suggested that the water circulation around the ultrasonic tip was prevented by the OVDs during ultrasound oscillation.

After a while, the temperature in the anterior chamber plateaued.

→ It was suggested that the water flow resumed around the tip when some volume of OVDs was aspirated.

The effect of Healon® at 60 seconds time was not significant.

This seems because Healon® is more easily aspirated than other OVDs.

The effect of HealonV® at any time points was significantly higher than other OVDs.

Healon V could hinder an adequate water circulation in the anterior chamber and induce temperature rise because of its good retention.

It was suggested that the HealonV® itself can be degenerated by the heat of 75 ℃ nearby.

Conclusion

In phacoemulsification, it is important to aspirate some volume of OVDs prior to the ultrasonic oscillation because it can form a working space which prevents an increase in the aqueous humor temperature .