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The implications of an ab interno vs. ab externo surgical approach on intraocular pressure (IOP) control.

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Abstract

Purpose : Novel micro-incision glaucoma surgery (MIGS) devices that drain into the subconjunctival space can be inserted via an ab externo or ab interno approach. Limited experimental data exists as to the impact of either technique on intraocular pressure (IOP) control. We performed microfluidic studies using ex vivo rabbit eyes to assess the effect of each approach for future MIGS devices.

Methods : A microfluidic approach was designed, consisting of a reservoir of water connected to a pressure pump/flow sensor (Fluigent, Villejuif, France). The flow rate of water was fixed at 2 μ l/min to simulate aqueous humour production. In the ab interno approach (n=6), a polyether ether ketone (PEEK) tube (internal diameter 125 μ m) was inserted through the ex vivo cornea into the sub-conjunctival space, bypassing the anterior chamber and resulting in bleb formation. In the ab externo approach (n=4), a superior limbal conjunctival incision was made to the level of the sclera. Blunt dissection of Tenon's and conjunctiva was performed in accordance with the Moorfields Safer Surgery System. PEEK tubings of the same dimensions to those in the ab interno approach were used. Conjunctival closure was performed using 8-0 Prolene (Ethicon, NJ, USA). The pressure readings were recorded at a frequency of 1 Hz. A baseline reading was made before tube insertion into the eye (PEEK tube length set to aim for an initial outflow resistance of 5-10 mmHg/ μ l/min) followed by measurements for a cumulative 2ml volume entering the subconjunctival space. Results were adjusted for

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water viscosity at 37°C and reported as outflow resistance (mmHg/ul/min \pm standard error of mean, SEM).

Results : The ab interno approach increased outflow resistance by 1.40 ± 0.38 mmHg/ul/min vs. ab externo 0.83 ± 0.30 mmHg/ul/min, and contribution to IOP was 69.1% greater (2.79 ± 0.76 vs. 1.65 ± 0.60 mmHg). Bleb formation was observed to be less predictable with the ab interno approach.

Conclusions : The ab interno approach demonstrated greater outflow resistance and less predictable bleb formation compared to the ab externo approach. Further studies are necessary to assess its statistical significance. These results could explain some current clinical results and have implications for long-term post-operative outcomes and could be an important consideration for future MIGS devices.

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