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Author Response to Letter

Author Response: Ab Interno versus Ab Externo Surgical Approach on Outflow Resistance of a Subconjunctival Drainage Device

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We thank Drs. Sheybani, Grover, and Fellman for their interest in our recent publication.[1]

With regard to the comment that our title created confusion, our article was clearly designed to investigate the differences in outflow resistance in the subconjunctival space between devices inserted via an ab interno versus ab externo approach. We explicitly described the limitations of our laboratory study performed on ex vivo rabbit eyes. We critically appraised the results in our article and pointed out that they were not the same as that performed clinically, and we were clear in describing the difference when placing a tube under a conjunctiva with dissection versus placing the same tube under the conjunctiva through an ab interno approach without dissection. This is important as it was not entirely clear in the previous scientific literature whether the immediate conjunctival resistance was different with these different methods of tube implantation. As such, we do not feel there is any confusion as to the experiments we carried out.

Our study enables the differences in subconjunctival tissue resistance to be clarified at the time of ab interno or ab externo implantation. Ab interno tube implantation clinically is ordinarily associated with minimal subconjunctival dissection, whereas ab externo tube implantation is normally associated with significant conjunctival dissection, hence the applicability of our study to the immediate postoperative period. The effects of wound healing and the use of antifibrotic agents rarely affect the outflow resistance of the subconjunctival tissues significantly in the immediate postoperative period, as they rely on cellular activity or its inhibition, which takes time to occur.

Drs. Sheybani et al.[2] state that the resistance for XEN 45 at 2 µL/min has been measured at 8.9 mmHg at 21°C and corrected to 6.28 mmHg at 37°C using their own specific flow apparatus. Our calculation of 10.3 mmHg via Hagen-Poiseuille at a flow rate of 2 uL/min is expected for 37°C. Pressure drop variabilities are owing to the manufacturing variability of tube internal diameter.

Drs. Sheybani et al.[1] then state that we "inappropriately position the Xen and the InnFocus/PreserFlo against one another purely based on surgical technique, which is likely not appropriate or accurate because the XEN implant can and is being placed ab externo with an open conjunctival technique." We investigated the differences between an ab externo insertion technique with conjunctival dissection and an ab interno tube implantation without conjunctival dissection, as these are by far the most common ways of inserting these types of externally draining devices. We found more variability in the outflow resistance immediately after ab interno insertion without conjunctival dissection with temporary rises in pressure within the flow apparatus above 21 mmHg, which was not found in the dissected conjunctiva. Although as we stated this is not the living eye, despite the experimental limitations we have stated, this does suggest that a nondissected conjunctiva may be more prone to an increased outflow resistance in the immediate postoperative period with devices inserted via an ab interno approach.

With regard to the comments by Drs. Sheybani et al.[2] relating to our discussion, we thank them for highlighting the additional XEN studies. We have not said that the InnFocus (Santen Pharmaceutical

Company Ltd, Osaka, Japan) is superior to the Xen implant (Allergan PLC, Irvine, CA, USA). However, we do reiterate our findings that the ab externo approach with conjunctival dissection showed less pressure variation and less outflow resistance in the immediate period following the experimental procedure. We believe our findings are accurate in an ex vivo setting, but further studies are warranted to assess their implications in an in vivo setting. We look forward to seeing further clinical studies to assess the role of Tenon's capsule on surgical outcomes of devices that drain into the subconjunctival space.

Drs. Sheybani et al.[2] mentioned that there is no study confirming the elements of the Moorfields Safer Surgery system being applicable to microshunts. In fact, the technique of applying mitomycin with the InnFocus/Preserflo implant was based on the Moofields Safer Surgery technique of applying a wide and posteriorly positioned surface area of mitomycin after posterior conjunctival dissection.[3] This considerably reduces the incidence of cystic blebs. This method was brought to the InnFocus team by Prof. Paul Palmberg and was included in the original teaching presentation on how to use mitomycin with the InnFocus implant. The use of mitomycin with our technique considerably improved the success rate of the InnFocus/Preserflo implant.

There is an ongoing debate as to how best to apply Mitomycin C (MMC), but it is still under debate which approach provides better clinical outcomes. We agree that a number of modifications are in process to improve the subconjunctival placement of MMC and device insertion. However, as Drs. Sheybani et al.[2] state, this is still an ongoing process.

We thank Drs. Sheybani et al. again for their comments on our article, and fully agree again as we have said that results observed in an ex vivo setting may not translate to results noted in an in vivo setting. It is important to continue to investigate these findings further, as they may have significant implications for future modifications of devices and surgical techniques including microtube revision surgery.

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