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Presentation Abstract

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Abstract Title:	**The Influence Of Scleral Flap Thickness, Shape, Suture Number And Position On Pressure Change And Aqueous Flow Direction In A New Trabeculectomy Model**
Presentation Start/End Time:	Thursday, May 10, 2012, 8:30 AM -10:15 AM
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Keywords:	473 computational modeling, 567 intraocular pressure, 548 image processing
Abstract Body:	**Purpose:** IOP changes and aqueous flow direction determined by the scleral flap immediately after trabeculectomy are critical determinants of the surgical outcome. The purpose of this study was to use a new large scale mechanical engineering model to objectively measure the influence of flap thickness, shape, suture number and position on both the pressure difference across a model scleral flap and the flow of fluid underneath it. The intended outcome was a valid model and enhanced understanding of how these different variables could affect the outcome of surgery. **Methods:** The physical model exploits the principle of dynamic and geometric similarity, so while the model flap dimensions were up to 30x greater than typical scleral flap dimensions, the flow had similar properties. Scleral flaps were modeled using transparent 0.8mm and 1.6mm thick silicone sheets on an acrylic plate. Dyed 98% glycerine, representing the aqueous, was pumped between the sheet and plate, and the equilibrium pressure measured with a pressure transducer. Image analysis was based on the principle of dye dilution and calculations were performed using

MATLAB software.

Results: The pressure drop across the flap increased with decreased flap thickness, due to reduced rigidity and resistance. Doubling the surface area of flaps and reducing the number of sutures from 5 to 3 or 2 also resulted in larger pressure drops. Flow direction was affected mainly by suture number and position, as it was minimal near the sutures and greater towards the nearest free edge of the flap. Posterior flow of aqueous was promoted by placing sutures along the sides of the flap and leaving the posterior edge free of sutures.

Conclusions: We demonstrated a new large-scale physical model of a scleral flap which is able to show how changes in flap thickness, shape and the number and position of sutures affect the pressure and flow characteristics after trabeculectomy.

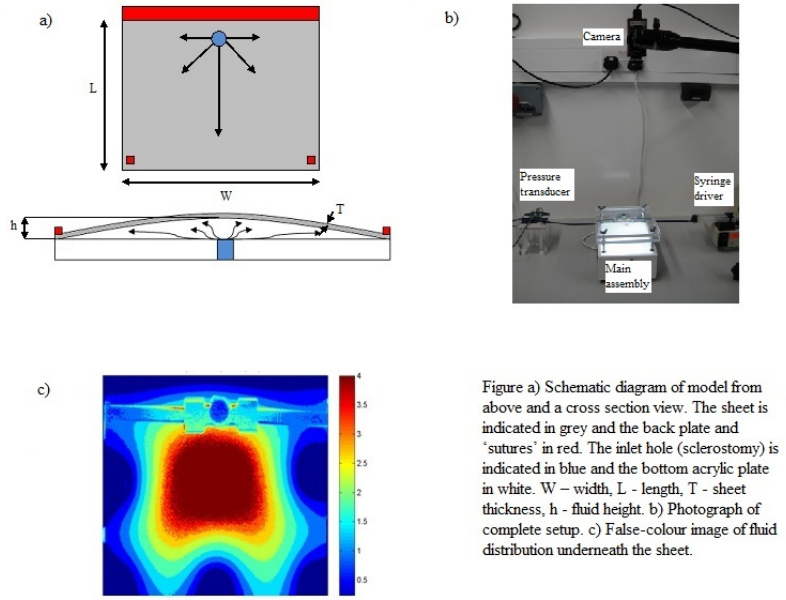

Figure a) Schematic diagram of model from above and a cross section view. The sheet is indicated in grey and the back plate and 'sutures' in red. The inlet hole (sclerostomy) is indicated in blue and the bottom acrylic plate in white. W – width, L - length, T - sheet thickness, h - fluid height. b) Photograph of complete setup. c) False-colour image of fluid distribution underneath the sheet.

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