Port Delivery System With Ranibizumab (PDS) Implant Insertion Procedure Optimization and Use of Virtual Reality (VR) Simulators in PDS Trials

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Purpose:
To report the optimized Port Delivery System with ranibizumab (PDS) implant insertion procedure and the first use of virtual reality (VR) technology as a tool for simulated surgical practice in an ophthalmic clinical trial.

Methods:
Ladder (NCT02510794) was a randomized phase 2 clinical trial in patients with neovascular age-related macular degeneration comparing the PDS with 3 customized formulations of ranibizumab with monthly intravitreal ranibizumab 0.5 mg injections. The occurrence of perioperative vitreous hemorrhage (VH) early in the trial led to optimization of the implant insertion procedure and the implementation of a robust surgical training model, including practice on VR simulators to maximize surgical outcomes.

Results:
A surgical study in minipigs conducted during Ladder identified the pars plana at the incision site as the source of perioperative VH. Among alternative surgical methods tested, scleral dissection at the insertion site followed by thorough 532-nm laser ablation of the full extent of the exposed pars plana using overlapping 1000-ms spots before PDS implant insertion was the most effective method to mitigate VH. With this procedure, the rate of perioperative VH decreased from 50% (11/22) to 4.5% (7/157). Surgery video review in Ladder showed that adherence to the specified surgical methodology was key to mitigating VH occurrence and other perioperative events. These learnings were implemented in the phase 3 Archway trial (NCT03677934) in the form of a surgical training model with VR simulation as a surgical practice option for Archway surgeons, to practice both the PDS implant insertion procedure and the refill-exchange procedure. Ladder surgeons who had previously performed these procedures generally felt that PDS VR simulators were sufficiently realistic for most procedure steps and would enhance the learning of these procedures by new investigators.

Conclusions:
Prophylactic laser ablation of the exposed pars plana before incision and PDS implant insertion was effective in mitigating VH in Ladder, and adherence to the specified surgical methodology was key to success with the optimized procedure. Archway was the first ophthalmic trial to offer surgeons simulated practice of procedures using VR technology to enhance surgical readiness and maximize patient outcomes.