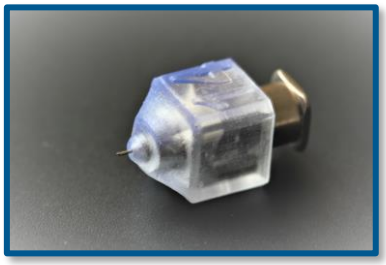
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Use of Microneedles to Inject into the Suprachoroidal Space

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The suprachoroidal space (SCS) is a potential space that is located between the choroid and sclera and thus surrounds the entire ocular posterior segment. Use of the SCS as a potential site for ocular drug delivery is advantageous because this route avoids substantial drug barriers such as the tear film, surface epithelium, conjunctival lymphatics, and the sclera. The SCS route of ocular drug delivery may also reduce or eliminate complications associated with intravitreal routes of therapy, such as opacities in the visual axis and vitreal hemorrhage. Since the SCS is adjacent to the entire choroid, drug delivery into the SCS has the potential for wide drug distribution to the ocular posterior segment, but allows limited exposure to the cornea and ocular surface.

To prepare an animal for SCS injection, following tranquilization, eyes are surgically prepared with topical 5% betadine, rinsed with sterile eyewash, and a topical anesthetic, such as proparacaine HCl is applied. The injection is then performed (see description below) followed by an application of a topical antibiotic applied to the ocular surface.

To perform the SCS injection, the microneedle is directed perpendicular to the conjunctiva/sclera surface beginning at 4-5 mm (small animal, dog/cat) or 8-10 mm (equine) posterior to the superior-temporal limbus. Initially, the smaller, 1100 µm length needle should be used. The needle is inserted perpendicular to the ocular surface and soft pressure is applied to the syringe plunger. As long as the needle is in the sclera, the injection cannot be made. While maintaining soft pressure on the syringe plunger, the operator progressively increases pressure of the syringe to the sclera creating a slight indentation. Once the tip of the microneedle enters the SCS space, but not before, the injection can be made without resistance. If the injection cannot be made despite indentation, then the larger 1400 µm length microneedle should be used as described previously. If an injection still cannot be accomplished, then the needle should be inserted 1 mm posterior to the first injection site and the injection process repeated. Successive posterior placement of the needle may be needed in some animals. Following injection of the drug into the SCS, the needle should be held in place for 5-10 seconds to allow drug distribution and minimize drug leakage. Alternatively, a sterile cotton-tipped applicator, or similar, can be applied with mild pressure to the injection site for approximately 10 seconds following removal of the microneedle.

Following injection, examination of the ocular posterior segment, if possible, should be done to ensure that the injection entered the SCS and was not delivered intravitreally or subretinally. Separation of the SCS and drug presence in the SCS usually can be imaged immediately after injection using optical coherence tomography or high frequency ultrasound if confirmation of drug delivery is needed.

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