The widespread adoption of small incision cataract surgery in the 1990s corresponded with the concomitant use of topical agents for anesthesia. Topical anesthesia is an excellent companion to small incision surgery because both lead to rapid postoperative vision recovery, minimal discomfort and improved patient satisfaction. Just as small incision cataract surgery reduces risks inherent in a large incision operation, topical anesthetics eliminate the risks of injection anesthetics.

There are various strategies for using topical anesthesia. Originally, topical aqueous eyedrops were the sole agent for anesthesia, but provided inadequate anesthesia for many patients. Gills and others used intracameral 1% unpreserved lidocaine as an adjunct when a patient had inadequate pain control with just the topical agent, and eventually this became routine for many surgeons who wanted to ensure the patient was as comfortable as possible. [1-5] Other surgeons preferred to avoid the off label use of lidocaine in the eye and waited for stronger topical agents.

In 1997, Falck and others reported using 2% lidocaine jelly as a topical agent. [6-8] This was soon shown to be more effective than eyedrops and possibly even as effective as intracameral lidocaine. Its use was limited, however, because once again this was an off-label use of an approved anesthetic, and because its application was messy - it is squeezed out of a tube or injected from a large syringe. It was also uncomfortable for the patient, because excess jelly could run down the patient’s cheek.

In 2005, the first ophthalmic gel anesthetic, TetraVisc (OCuSOFT, Inc., Richmond, TX) was introduced. TetraVisc is a viscous preparation of tetracaine hydrochloride 0.5% developed to improve corneal contact time over traditional anesthetic eyedrops and increase anesthetic effect. Amiel and others compared this viscous gel to lidocaine jelly and found the anesthetic effect similar. [9-10] However, TetraVisc was packaged in an ophthalmic dropper bottle so it was delivered as an eyedrop rather than a ribbon, making it easier to administer and less messy than the off-label lidocaine jelly.

In 2008, another gel anesthetic agent followed. Akten (Akorn, Lake Forest, IL) is a viscous preparation of lidocaine hydrochloride 3.5% and is, like its tetracaine predecessor, packaged in an ophthalmic dropper bottle making it easy to deliver.

In 2009, TetraVisc Forte (OCuSOFT, Inc.) was introduced. This is a newer formulation of the tetracaine gel with even higher viscosity to further increase corneal contact time.

We decided to evaluate these three ophthalmic anesthetic agents and see how they compare against intracameral lidocaine.

Following IRB review and approval for a randomized, prospective, double-blinded study, 160 eyes were randomized into one of four groups: three groups received topical anesthesia only, either TetraVisc, TetraVisc Forte, or Akten, and all also received 0.5 cc of a balanced salt solution administered intracameral. The fourth group received topical proparacaine drops, and then 0.25 cc of 1% unpreserved lidocaine administered intracameral. Patients were asked to score their pain levels on a 1-10 scale prior to surgery to be sure they understood the scoring system. Patients were again asked to score their intraoperative pain levels shortly after completion of the operation.

Average pain scores were as follows: TetraVisc 1.08, TetraVisc Forte 0.55, Akten 0.60, and 1% intracameral lidocaine 0.10.

Statistical analysis was performed using the Student t-test software available with Microsoft Excel, Office 2000.
Patients in the group that received TetraVisc alone had a pain score of 1.08 on a 1-10 scale. This was higher, with statistical significance compared to the other three groups. (to TetraVisc Forte, p=0.47, to Akten p=0.022, to intracameral lidocaine p<0.001).

The patients in the groups that received TetraVisc Forte or Akten had average pain scores of 0.55 and 0.60 respectively. There was no statistical significance to the difference.

The patients in the group that received intracameral 1% lidocaine had average pain scores of 0.10, and compared to the other three groups there was statistical significance across the board (to TetraVisc p<0.001, to TetraVisc Forte p=0.003, to Akten p=0.020).

Based on these results, TetraVisc Forte and Akten have similar anesthetic properties. Both are better than the original TetraVisc. None of the three are as effective as 1% intracameral lidocaine.

Akten is packaged in a 5 ml bottle with a list price of $31.24, is unpreserved and packaged for single use only. Avoiding preservatives has a theoretical advantage in preventing transient BAK (benzalkonium) keratitis, though this is usually a concern with preserved eyedrops that are used over a long period of time. The one or two drops used prior to surgery should infrequently have any effect. The downside of using non-preserved eyedrops is, of course, the potential for contamination if used for one patient, and cross-contamination if used for more than one patient. For that reason, the package insert states that Akten is indicated for single patient use only.

TetraVisc Forte is preserved with BAK, and so the 5 ml bottle with a list price of $17.95 is a true multi-dose container. That means it can be used for multiple patients over multiple days. It also comes in a 0.6 ml unit-dose bottle compliant with OSHA or facility regulations after use on each individual patient. The small unit-dose bottles have a list price of $78.00 per box of 12, or $6.50 per bottle.

The cost per patient is a big differentiating factor. Because Akten is a non-preserved single patient medication, its entire cost is allocated to one patient, making the cost per patient $31.24. The TetraVisc Forte unit-dose bottles are also allocated to one patient, but at a cost of $6.50 per patient. TetraVisc Forte 5 ml is a true multi-dose bottle, with enough drops for about 30 patients. That puts its cost per patient at $0.59.

So, when comparing the advantages and disadvantages of the two viscous anesthetics, Akten is a non-preserved drop, perhaps avoiding BAK keratitis, but at very high cost.

TetraVisc Forte has the same anesthetic efficacy, but its unit-dose bottle costs only 20% as much per patient as Akten. The TetraVisc Forte 5 ml multi-dose bottle has a cost per patient of $0.59, or 1.8% the cost of Akten.

**Summary**

Both TetraVisc Forte and Akten provide excellent and equivalent topical anesthesia. However, the cost per patient for Akten is five times as much as the TetraVisc Forte unit-dose bottles and 55 times as much as the TetraVisc Forte multi-dose bottle.

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Patient-reported intraoperative pain scores, 40 patients each group, 1 – 10 pain scale. There was no statistical difference between TetraVisc Forte and Akten. Both were significantly better than TetraVisc. 1% intracameral lidocaine was significantly better than all the gels. See text for details.

While both gels had comparable anesthetic effect, there is a significant difference in cost per patient. The per patient cost of Akten is 55 times higher than TetraVisc Forte packaged in a multiuse bottle, and five times higher than TetraVisc Forte packaged in a unit-dose bottle.