New injectable lenses show promise in the restoration of accommodation

We think that the most promising concept for restoring lost accommodation is an injectable intraocular lens."

"We think that the most promising concept for restoring lost accommodation is an injectable intraocular lens."

Dr Koopmans noted that one of the problems they had to overcome in the course of their research was devising a means to prevent postoperative inflammation and capsular fibrosis after monkey implantations. They therefore developed a new protocol for implanting the material which involves treating the capsule with a new compound developed by AMO that prevents PCO followed by subconjunctival injection of triamcinolone, and the application of antibiotic and steroid eyedrops for the first two postoperative weeks. The researchers found that eyes that underwent injection of lens material according to the new protocol remained relatively clear. By comparison, one eye that underwent injection without the new protocol developed considerably more fibrosis in the centre of the capsule and became increasingly myopic due to shrinkage of capsular bag.

One of the hurdles yet to be overcome is the development of a method of determining either pre- or intraoperatively how much fluid to inject in the capsule for optimal refractive results.

"We now have a material that allows accommodation in both vitro and in vivo experiments, which fulfils all requirements necessary for an injectable IOL. Material is therefore not a limiting factor and we can continue to work on other issues as we head towards clinical trials," Dr Koopmans added.

The rhexis-capping approach

Okihiro Nishi MD in Osaka, Japan is working on another approach to fluid injectable IOLs. His technique involves removing the crystalline lens through a standard capsulorhexis, filling the capsule with a fluid silicone mixture and then capping the rhexis with a special capsule-fitting lens.

Eyes undergoing the procedure would have two simultaneous mechanisms of accommodation: the forward movement of the lens and an increase in the thickness of the fluid in the capsule, Dr Nishi told the Paris Congress.

Dr Koopmans noted that one of the problems they had to overcome in the course of their research was devising a means to prevent postoperative inflammation and capsular fibrosis after monkey implantations. They therefore developed a new protocol for implanting the material which involves treating the capsule with a new compound developed by AMO that prevents PCO followed by subconjunctival injection of triamcinolone, and the application of antibiotic and steroid eyedrops for the first two postoperative weeks. The researchers found that eyes that underwent injection of lens material according to the new protocol remained relatively clear. By comparison, one eye that underwent injection without the new protocol developed considerably more fibrosis in the centre of the capsule and became increasingly myopic due to shrinkage of capsular bag.

One of the hurdles yet to be overcome is the development of a method of determining either pre- or intraoperatively how much fluid to inject in the capsule for optimal refractive results.

"We now have a material that allows accommodation in both vitro and in vivo experiments, which fulfils all requirements necessary for an injectable IOL. Material is therefore not a limiting factor and we can continue to work on other issues as we head towards clinical trials," Dr Koopmans added.

The rhexis-capping approach

Okihiro Nishi MD in Osaka, Japan is working on another approach to fluid injectable IOLs. His technique involves removing the crystalline lens through a standard capsulorhexis, filling the capsule with a fluid silicone mixture and then capping the rhexis with a special capsule-fitting lens.

Eyes undergoing the procedure would have two simultaneous mechanisms of accommodation: the forward movement of the lens and an increase in the thickness of the fluid in the capsule, Dr Nishi told the Paris Congress.

The capsule-fitting lens has an overall length of 13.0 mm and a thickness of 1.2 mm. The optic of the lens has three components, an anterior optic of 6.0 mm, a posterior optic of 6.5 mm and a real optic of 5.5 mm.

"The shape is similar to that of a conventional IOL, but the optic has small narrow groves over its entire circumference. The CCC edge is put in this groove, which chokes the lens, preventing leakage of the injected material."

Experiments in rabbit eyes have shown that the capsule-fitting lenses are effective in preventing leakage of the fluid silicone material and that the material can completely fill the capsular bag. To perform the procedure Dr Nishi first extracted the crystalline lenses from the eyes via phacoemulsification through a 3.00mm -4.5 mm capsulorhexis. He then placed the lens inside the capsular bag and used a Sinskey hook to manoeuvre the lens so that the grooves of the optic captured the edge of the rhexis. He then pulled back a small portion of rhexis edge with a Sinskey hook and injected the fluid silicone material.

"The lens capsule that was closed by the IOL was well refilled. The slight amount of the injected material that leaked during the injection could be easily removed from the anterior chamber by aspiration at the end of surgery. When the CCC choked the IOL, there was leakage after the injection."

Dr Nishi noted that, in addition to preventing leakage, the lens also appeared to prevent anterior capsule fibrosis. However, PCO remained a problem. He added that tests of the lenses accommodative amplitudes await trials in primate eyes and he suggested that a light-adjustable version of the lens might enable patients with the lens to achieve optimal refractive results.

"The IOL has proven to be effective on preventing leakage of the injected liquid material with high reproducibility, when CCC was created at a proper size. This new lens refilling procedure appears to be promising," he added.

s.a.koopmans@ohk.azg.nl
okihiro@nishi-ganka.or.jp