Phaco continues to evolve in the new century

PHACO EMULSIFICATION cataract surgery has come a long way since Dr Charles Kelman’s famous epiphany in the dentist’s chair in the early 1960s. The idea that ultrasonic energy could be used to break up cataractous lenses was considered completely outrageous at the time, but of course now it has become the standard approach in the western world.

Considering that in the initial procedure Dr Kelman used a four-pound ultrasound handpiece, in a surgery that took four hours including 41 minutes of ultrasound time, resulting in endophthalmitis and phthisis in a blind patient, it is not hard to understand the early objections. However, he persevered, and in subsequent decades the technology has evolved to its current state where a standard cataract can be removed in a matter of minutes, using one of the safest surgical methods ever developed.

Each development in phaco surgery set the stage for the next. In the 1970s pioneering surgeons including Drs Sinskey and Kutz introduced improved surgical techniques such as the posterior capsulotomy technique and the iris plane technique. The 1980s saw the advent of the major developments including the use of the capsulorhexis, and key improvements in technology, notably viscoelastics and foldable IOLs.

With the 1990s came important refinements in ultrasound systems, which led to reduced energy requirements for phacoemulsification. The current decade has seen important developments both in surgical technique, in the form of microincision surgery, and in the hardware and software used in the procedure.

What remains to be done in the field? Recent technological developments give some indication of the ongoing improvements. Each of the major phacoemulsification system makers has rolled out or will soon debut new innovations in the equipment used to perform modern cataract surgery.

The wizardry of Ozil

The new Ozil torsional handpiece (Alcon) was one of the big stories at the XXIV Congress of the ESCRS in London. Surgeons enthusiastically demonstrated the advantages of the torsional approach, emphasising the enhanced efficiency and safety of the system during live surgery and free paper sessions. Ozil provides a combination of hardware and software upgrades to Alcon’s existing Infiniti Vision System. Most notably, a new oscillating tip changes the energy profile of the tip and the reaction of the lens material contacted by the vibrating needle. Unlike traditional ultrasound, there is no forward and backward movement of the tip with torsional ultrasound. In the torsional mode, the handpiece oscillates from side to side at approximately 32,000 times per second. These faster, lower frequency oscillations provide a 20 percent energy saving with reduced risk of thermal burn, surgeons reported.

“Torsional phaco significantly reduces undesirable aspects of traditional phaco such as cavitation, turbulence and repulsion. Our research findings help to explain the clinical observation of improved followability, reduced BSS consumption and overall improved surgical outcomes of torsional phacoemulsification,” said Jaime Zacharias of the Clinica Oftalmologica Pasteur, Santiago, Chile.

Stellaris goes with the flow

Attendees at the London ESCRS Congress also got a glimpse of the new Stellaris phacoemulsification system developed by Bausch and Lomb. The system allows cataract surgeons to perform either standard coaxial or sub-2.0mm microincision bimanual phacoemulsification surgery. It can be customised by the surgeon for either venturi or peristaltic fluidics.

The tubing system of Stellaris includes an aspiration tubing line with an internal diameter of 1.0mm. There is a filter in the proximal part of the line that captures nuclear fragments larger than 0.5mm. This allows the surgeon to increase the vacuum without increasing the aspiration flow rate. “The Stellaris at last breaks the link between vacuum and aspiration flow in phacoemulsification. The stable chamber tubing system of Stellaris, along with dual linear control, allows us to operate with high vacuum settings without compromising chamber stability or increasing the risk of post-occlusion surge,” reported Ann Haustermans MD, AZ Klina Hospital, Brachaaat, Belgium, at the London meeting.

She demonstrated using the system in both the conventional coaxial setting as well as for bimanual microincision surgery, noting that the new system was particularly well designed for the latter application.

The Stellaris system features include a touch-screen navigation interface, streaming video, wireless foot pedal controls, and specialised MICS instrumentation. A Bluetooth activated voice command system is also in development.

AMO adds its Signature

The Sovereign W hiteStar phacoemulsification platform (AMO) introduced many innovations to the field including digital energy modulation and advanced capsular protection. The company will debut ‘Signature’, a new enhancement to the technology at this year’s meeting of the ASCRS in San Diego, California.

Company sources told EuroTimes that the Signature technology was designed to optimise chamber stability through an innovative dual pump fluidic system that would allow the highest efficiency with lowest power use. Features include an intuitive touch screen control panel, wireless remote, an optional wireless foot pedal, as well as a video overlay teaching tool. The system can also be used for high-speed anterior vitrectomy.

The various new phacoemulsification technologies have evolved in response to collaboration between surgeons and engineers, and reflect the evolution to ever-faster surgery through ever-smaller incisions. “OZ II is indeed a significant improvement because we have almost no repulsion and an ability, with dramatic reductions in energy, to remove nuclei of all densities. Torsional phaco is a reality. I think other improvements will come and we do look forward to the appearance of the Stellaris from Bausch and Lomb and the Signature by AMO. I am going to be working with these machines and I believe they will provide improvements in both fluidics and power modulations, and the improvements are going to be significant,” Howard Fine MD, clinical professor, Casey Eye Institute, Oregen Health & Science University, Portland, Oregon, told EuroTimes.

Dr Fine said he expects to see continued innovation in phacoemulsification, particularly in the area of microincision surgery. He believes development in bimanual microincision phaco will ultimately achieve a totally closed system, so there will be no incisional leakage. This will be hastened by the development of suitable microincision IOLs.

He noted that he was looking forward to another important development, a way of totally preventing posterior capsule opacification and keeping the capsule fully elastic, saying he believed this would ultimately be a pharmacological solution. Other leading makers of phacoemulsification systems have also continued to innovate. Staar Surgical for example has created the Sonic W ave, currently only available in the US, a system that allows the surgeon to switch between low energy sonic (40-400Hz) and traditional ultrasonic power, depending on the cataract being removed. The Sonic Wave also includes unique coiled tubing that allows for reliable chamber stability at extreme vacuum levels.

Swiss manufacturer Oertli continues to add refinements to its O S 3 phaco platform. The system allows surgeons to switch between peristaltic and venturi pumps during surgery and provides a lot of flexibility in programming pulse settings. They have introduced a new tip for coaxial and pars plana microincision surgery.

W ith recent CE approval of its CV-7000 phacoemulsification system, Nidek entered the European market. The system provides a high-repetitive pulse mode for optimal operability and reduced heat generation. Its Pro-Pedo Mode allows a high anterior chamber stability, providing for greater visualisation and faster surgery times.