Three broad trends are evident in cataract surgery: (1) the reduction in the size of incisions necessary for phacoemulsification and lens implantation, (2) the increasing popularity of single-use instruments, and (3) cost reduction as a corollary of economic imperatives, in particular a drop in the rates paid for standard procedures. Reduced incision sizes demand precision and reliability from both the surgeon and the instruments he uses; however, precision is not always compatible with repeated use and resterilization of instruments. In this respect, single-use instruments are an interesting alternative to reusable instruments that may see increasing use in ophthalmology.

Although it is not yet clear how long such transition will take, single-use instruments have advantages over reusable ones because of technical, regulatory, and economic reasons. First, the ability to use these instruments in microincision cataract surgery (MICS) has markedly increased. Second, sterilization regulations have not changed recently, but they must be applied rigorously. Third, the cost of single-use instruments is falling compared with their resterilizable counterparts. Single-use instrumentation is a strong trend in health care in general and should continue to spread to ophthalmology.

One prerequisite for increased preference for single-use instruments is an improvement in quality, which must be comparable if not better than reusable instruments. For a long time, single-use meant relatively poor quality at a high price. That is no longer the case for most single-use instruments, primarily due to striking technological progress. Previously, it was often a manual finishing process that determined the cost and performance of instruments. Technological advances now allow higher quality at lower cost, and single-use instruments provide improved effective-ness, especially for MICS because instruments such as capsulorrhesis forceps can now be used only once.

On certain single-use forceps, a U-shaped metal core provides rigidity determined by the force of the spring (Figure 1). The metal core is mounted in a plastic handle; once in place, it guarantees control and perfect alignment of the active parts. This function allows factory calibration of the spring according to the type of forceps and the particular rigidity required. With other forceps, the plastic body itself determines the force of the spring. Single-use forceps may
also have jaws that grip the capsule through small incisions or rear jaws that prevent the forceps from reopening if the sleeve is squeezed too tightly (Figure 2).

The flexibility of this fabrication process is so great that the shape and size of the pincer tips as well as the angle, thickness, and camber of the arms can be varied. Such variety will be useful in the future when 2.2-, 1.8- and 1.5-mm incisions become common. Additionally, highly automated fabrication means that products can readily evolve in line with—or ahead of—surgical techniques. This production process also decreases production costs and is more competitive with reusable instrument pricing.

**CATEGORIES**

There are three basic categories of single-use instruments, mono-material steel, mono-material plastic, and bimaterial plastic-steel.

**Mono-material steel instruments.** These single-use instruments are usually of mediocre quality, although BD (Franklin Lakes, New Jersey) has just launched a full range of well-performing instruments compatible with MICS. Other companies that offer mono-material steel instruments include Accomed (Theizé, France), Ovation Pharmaceuticals, Inc. (Deerfield, Illinois), Phakos (Montreuil, France), and Carl Zeiss Meditec (Jena, Germany).

**Mono-material plastic instruments.** In their present form, mono-material plastic instruments are not a credible alternative because they are too large and too fragile. However, the idea that certain instruments (aside from capsulorrhexis forceps and manipulators) can be made of plastic should be kept in mind when considering cost reduction. Supra Médical Ltd. (Marseille, France) offers a line of mono-material plastic instruments.

**Bimaterial plastic-steel instruments.** The specific shape of the handle in bimaterial plastic-steel instruments, sometimes with small relief points, provides optimal ergonomics. Bausch + Lomb (Rochester, New York; Figure 3), BD (Figure 4), and Moria (Antony, France; Figure 5) offer bimaterial plastic-steel instruments. The plastic handle is easily removable to properly sort recycling metal and plastic. Bimaterial plastic-steel single-use instruments are currently the most ergonomic option. They cannot be resterilized. Overall, they are high-quality instruments, but disparities exist particularly when incisions 2.2-mm or smaller are constructed.

**SINGLE-USE KITS**

Capsulorrhexis forceps are undeniably the key instruments in single-use MICS kits. The forceps determine the kit’s price and quality—although it is true that an effective single-use capsulorrhexis instrument presupposes a manufacturer’s technological prowess. It must be made of a solid and resistant material, its jaws must be extremely fine, and the intraocular parts of its arms must be parallel. The maximum distance between the jaws of the capsulorrhexis forceps must match the incision. The tip (ie, the part farthest from the body) must be compatible with the microincision and must maintain good visibility. Finally, the body must be ergonomic, allowing a good grip throughout all stages of the capsulorrhexis, regardless of the position of the forceps.

In practice, the other instruments in the kit do not need to be as exact. The composition of the kit depends on each operator and his technique.

**EFFECTIVENESS**

Why does single-use increase the effectiveness of instruments? The first difference lies in the automated fabrication method, which avoids the variability resulting from the manual finish of reusable instruments. Manual fabrication induces variations between one instrument and another, and indeed between one operator and another. These variations do not necessarily affect the functionality of the product unless precise adjustments are needed, such as with MICS instruments.

Automated fabrication of single-use instruments can result in finer and more fragile instruments that are not subject to stringent durability requirements. Obviously a product that must withstand repeated cleaning and sterilization, including exposure to aggressive chemical agents,
must be designed appropriately. Thus, a single-use instrument may not only match the quality of a reusable instrument but may also be finer, more fragile, and more effective because it will be used only once.

The durability of an instrument is in large part linked to how it is used and maintained, and this is all the more true with MICS as well as microincision retinal procedures. Outsourced sterilization seems to increase the risk of breakage. On the other hand, the design of single-use instruments can keep pace with surgical advances without problems linked to instrument aging or obsolescence.

REGULATORY FACTORS

There are two types of technical surgical factors that will increase the use of single-use instruments. First, as surgeons improve their skills in phacoemulsification, they will be able to adapt to new instruments quickly and reduce the number of instruments they use in standard procedures to approximately five, thus reducing the cost of single-use kits. Second, the adoption of reduced-size incisions, which accelerated enormously last year in France, requires suitable instruments. In particular, the capsulorrhexis forceps must be compatible with incision sizes between 2.2 and 1.5 mm.

Regulations have not changed recently and impose no requirements on single-use instruments apart from strongly encouraging their use. Circular 138 (No. DGS/SC/DHOS/E2/2001/138) of the French hospital authority (Fédération des Établissements Hospitaliers & d’aide à la Personne), last updated in March 2001, summarizes the recommendations for reducing the risk of transmitting unconventional transmissible agents (UCTA) in France. As translated from French, the circular “recommends single-use for all equipment in contact with tissue at risk, where safety and quality of care must be ensured. When single-use is not possible, it recommends—taking into account the type of procedure, the tissue concerned, and the level of risk for the patient—treating the equipment using the most effective UCTA inactivation process that the equipment can withstand.”

The French directorate for hospitalization and organization of health care services commented on Circular 138 as it applies to ophthalmology. As translated from French, “UCTAs represent a risk that has not yet been assessed in practice. The eye is considered to be infectious tissue in terms of UCTA. The retina is considered to be the nervous tissue most susceptible to infection. Based on current knowledge, it is therefore justifiable to take maximum UCTA precautions in ophthalmic surgery.”

COST OF STERILIZATION VERSUS SINGLE-USE

Expense has been one of the limiting factors for the adoption of single-use surgical instruments. However, reusable instruments require resterilization, which also represents a cost. Relative costs for any particular establishment are difficult to determine. Opinions must no longer take precedence over objective assessments, which must be made in the near future. The Steriprocess (Steriprocess International, Belgium) can be used to assess the costs associated with sterilizing a medical device. The cost of outsourced sterilization is between €42 and €50 per box. However, some single-use boxes may be purchased for as low as €30 per box.

We evaluated the cost of a standard pack of five instruments on the French market, which included a speculum, Bonn forceps, microincision capsulorrhexis forceps, manipulator, and tying forceps. Table 1 lists the costs as of March 2010 for each kit. Disparities in price did not correlate with the quality of the instruments. On first analysis, the pretax cost of moving to single-use is always less than the cost of resterilization, with labor representing the heaviest financial burden on reusable instrumentation. Therefore, in financial terms, single-use is potentially more cost-effective than sterilization—provided the instruments are equivalent technologies.

Aside from cost, each surgeon makes his own decision on whether he prefers reusable or single-use instruments. We have found that single-use instruments have advanced enormously in terms of fabrication quality, surgical effectiveness, and cost reduction. The need for reliable instruments that are compatible with MICS and microbiological safety is driving this change. It seems inevitable that single-use instruments will become commonplace in cataract surgery in the future.

Thierry Amzallag, MD, practices at the Ophthalmic Institute of Somain, France. Dr. Amzallag states that he has no financial interest in the products or companies mentioned. He may be reached at e-mail: Thierry.amzallag@institut-ophtalmique.fr.