Same-day sequential cataract surgery

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Purpose of review

Simultaneous bilateral cataract surgery (SBCS) is gaining in popularity worldwide. Whereas 5 or 10 years ago, it was only performed by scattered individual surgeons, it is now rapidly becoming accepted and mainstream.

Recent findings

Cataract surgery is generally performed on older patients. The reduction in medical visits, avoidance of interprocedural anisometropia and decreased stereopsis, and very rapid rehabilitation made possible by SBCS make the surgery much easier on the patients and their families. The fears of SBCS, most notably bilateral postoperative endophthalmitis, seem unfounded, as long as established precautions are followed. Some jurisdictions continue to penalize surgeons financially for performing SBCS, thus discouraging its spread. Unlike the Royal College of Ophthalmologists, UK, Surgery Guidelines, the American Academy of Ophthalmology's 2006 Preferred Practice Patterns do not include relative indications for SBCS.

Summary

SBCS will likely become rapidly more common around the world during the coming decade, to the great benefit of patients, institutions, and funding agencies.

Keywords

bilateral cataract surgery, immediately consecutive cataract surgery, same-day sequential cataract surgery, simultaneous bilateral cataract surgery

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Introduction

Same-day sequential, immediately consecutive, or simultaneous bilateral, cataract surgery (SBCS) is the procedure of performing both cataract surgeries, of the same patient, sequentially, in one sitting. We refer to the procedure as SBCS throughout this review, as it is the most commonly utilized term. SBCS has always been controversial. It must be undertaken with great care, and performed under complete aseptic technique, with strict separation of right and left surgeries. Unilateral complications after SBCS are comparable to those reported after unilateral cataract surgery (UCS). Bilateral complications are rare, with the greatest fear, bilateral endophthalmitis, having been reported in four patients since 1978, all attributable to technique issues. SBCS surgeons, and their patients, should be prepared to defer second eye surgery should a significant problem occur with the first eye. SBCS benefits both health systems and patients, and as our surgical techniques improve, as we gradually move toward ever greater proportions of refractive lens exchanges, it is a logical and probably inevitable step to our goal of visual rehabilitation.

History and prevalence of simultaneous bilateral cataract surgery

Same-day sequential cataract surgery was first reported in 1952 [1]. Historically, SBCS was performed initially with intracapsular cataract extraction (ICCE), and subsequently with extracapsular cataract extraction (ECCE), and phacoemulsification, with more large series originating from the UK (Table 1) [1–19,20•,21,22]. SBCS publications per decade have steadily increased, especially after 1995 [23]. To our knowledge, countries where SBCS is commonly being performed with increasing interest and safety include: Australia, Austria, Canada, China, Finland, Great Britain, Iran, Israel, Japan, Turkey, South Africa, Spain, Sweden, Poland, and United States of America (although with differing frequency roughly inversely proportional to local financial disincentives) [24]. In Finland, the battle for acceptance of routine SBCS occurred in the 1990s, and routine SBCS has been common since 1996, where many hospitals perform SBCS on 40–60% of patients, resulting in the Finnish experience of SBCS being greater than the rest of the world combined [20•,25••].

Table 1 Selection of simultaneous bilateral cataract surgery performed in adults reported in the literature (1952–2008)

Author	Location	Number of patients	Technique/results and points emphasized
Chan and De La Paz [1]	Philippines	Not mentioned	ECCE
Benezra and Chirambo [2]	Malawi	448	ICCE
Beatty *et al.* [3]	UK	319	BCVA: 41% $\geq$ 6/6, 83.1% $\geq$ 6/12
Diaper *et al.* [4]	UK	Not mentioned	SBCS phacoemulsification
Pearce and Masket [5]	UK	129	Patient preference for SBCS, positive results
Bolger [6]	UK	350	Phaco: low risk of bilateral endophthalmitis
Ramsay *et al.* [7]	UK	259	453 eyes ECCE/60 eyes phaco BSCVA: 75% $\geq$ 6/12
MacDonnell [8]	UK	1	Bilateral corneal decompensation after SBCS
Keskinbora [9]	Turkey	>100	Low incidence of complications
Sharma and Worstmann [10]	UK	144	SBCS complications similar to UCS VA: 87% $\geq$6/9
Kontkanen and Kaipiainen [11]	Finland	2755	Anisometropia not a significant problem, no cases of bilateral endophthalmitis
Wertheim and Burton [12]	UK	109	BCVA: 47% $\geq$ 6/6, 86% $\geq$ 6/9
Arshinoff *et al.* [13]	Canada	1020	Phaco: Low complication rate
Chang [14]	USA	>6000 since 1995	BJO editorial review reporting no cases of bilateral endophthalmitis from 1995–2003
Johansson and Lundh [15]	Sweden	220	VA $\geq$20/40 in 78% of eyes
Sarikkola *et al.* [16]	Finland	141	BCVA 84% $\geq$20/40, 96% surveyed viewed experience as positive
Ozdek *et al.* [17]	Turkey	1	Case report of bilateral endophthalmitis
Packard [18]	UK	100	SBCS with ReSTOR IOLs (Alcon)
Lundstrom *et al.* [19]	UK	96	Randomized trial: Quicker visual recovery and better contrast sensitivity of SBCS vs. UCS
Nassiri *et al.* [20•]	Iran	220	More rapid rehabilitation of visual function in SBCS vs. UCS in nonrandomized trial
Chalioulias and Tsaloumas [21]	UK	1	Bilateral CME case report
Kim *et al.* [22]	Korea	1	Bilateral TASS case report (not SBCS)

All reports since 1999 were with phacoemulsification and PC IOLs. BCVA, best corrected visual acuity; BJO, *British Journal of Ophthalmology*; CME, cystoid macular edema; ECCE, extracapsular cataract extraction; ICCE, intracapsular cataract extraction; IOL, intraocular lens; ISCS, immediately sequential cataract surgery; SBCS, simultaneous bilateral cataract surgery; TASS, toxic anterior segment syndrome; UCS, unilateral cataract surgery; VA, visual acuity.

Although not many published, randomized, controlled studies exist comparing UCS versus SBCS, postoperative endpoints following SBCS, such as best corrected visual acuity (BCVA), are favorable, if not better than those following UCS (Table 1). We believe that BCVA or UCVA are UCS technique issues, and really not relevant in the global discussion of SBCS, in which the emphasis should be upon complications, rapidity of visual rehabilitation, patient, doctor and institutional benefits versus risks, and patient preference. In a recent randomized study [19] comparing patients undergoing SBCS versus delayed sequential cataract surgery (DSCS or UCS $\times$ 2) with a 2-month interval between eyes, faster visual rehabilitation during the first 2 months was noted in the SBCS group. Although at 4 months those differences were no longer significant, the SBCS group's VF-14 score (self-reported visual function) improved more and attained a higher value than the UCS group.

Simultaneous bilateral cataract surgery in children

Same-day sequential cataract surgery is not as commonly practiced in children, because cataract surgery is far less common in children, and patient management in children is more complicated and requires more individualization. Age, amblyopic status, presence or likely onset of nystagmus, intraocular lens (IOL) calculation, and general anesthesia are just some of the issues complicating pediatric cataract surgery. Pediatric SBCS has yielded positive results with respect to a reduction or resolution of nystagmus, and comparable or better visual outcomes than those attained after UCS $\times$ 2 (Table 2) [26–30].

Table 2 Simultaneous bilateral cataract surgery reported in pediatric patients (1990–2008)

Author	Location	Number of patients	Technique/results
Guo *et al.* [26]	USA	2	Resolution or reduction of nystagmus after removal of bilateral congenital cataracts
Yagasaki *et al.* [27]	Japan	5	Resolution or reduction of nystagmus after removal of bilateral congenital cataracts
O'Keefe *et al.* [28]	Ireland	13	Small incision phaco with good visual results in children ranging from 1 week to 8 years old
Totan *et al.* [29]	Turkey	17	No serious complications. BCVA: 84.4% $\geq$6/12, 31.0%$\geq$6/6
Ledoux *et al.* [30]	USA	139 eyes (SBCS + UCS)	Better visual outcome for SBCS vs. UCS, median of 20/25 versus 20/40 at mean 3.6 year follow-up

UCS, unilateral cataract surgery; SBCS, simultaneous bilateral cataract surgery.

Table 3 Authors' six recommendations to assure safety with simultaneous bilateral cataract surgery

SBCS precautions	Explanation
Intracameral antibiotics	Intracameral antibiotics have been shown, in the ESCRS study to reduce the rate of postoperative endophthalmitis by 80%. Despite excellent incisions, and other prophylactic steps, the authors feel that SBCS should not be undertaken without this additional precaution. The authors prefer intracameral moxifloxacin as the broadest spectrum, safest agent available.
Complete sterile separation of R & L OR tables	In order to completely avoid cross-contamination between left and right eyes, we advise that the surgical tables for the two procedures be kept separate, prepared separately, and that nothing should be transferred from one table to the other once the first procedure is commenced. The nurse and surgeon should change at least their gloves between eyes, and the patient should be re-prepped and draped.
List surgical criteria for R & L eyes on a board in the OR visible to all	Every person participating in SBCS should understand how IOL calculations are done, and should be able to read and understand the patient's chart. Before the first eye surgery is started the surgeon should list the IOL type and power for each eye on the board, as well as the angle of the steep axis of each cornea and the magnitude of astigmatism for each eye, thus minimizing errors in IOL power and type, and incisional location, and size and positioning of LRIs.
Militaristic recitation of IOL calculations as the lens is passed into the surgical field.	As the IOL is passed from circulating nurse to the scrub nurse, the IOL choice and calculations should be read out loud for that eye, so that everyone in the OR is aware that the correct IOL is being used.
Use different everything for R & L eye surgeries	In order to avoid the possibility of using a commonly contaminated device in both eyes, use separate everything for R & L procedures. We recommend separate BSS lots (if available) and OVDs from separate lots, or even different companies, because OVDs carry the highest risk of bioburden of any ophthalmic device.
Scrub nurses change between eyes, not in the middle of one eye's surgery	Nursing breaks should be structured such that changes can occur between right and left eyes of patients, thus allowing the incoming nurse to prepare the second eye table while the first eye is being completed, and reducing the risk of cross contamination with the first nurse leaving after the first eye is completed.

UCS, unilateral cataract surgery; SBCS, simultaneous bilateral cataract surgery.

Performing simultaneous bilateral cataract surgery (Table 3)

This section outlines some of the issues that a surgeon must address when performing SBCSTable 3.

Patient selection for simultaneous bilateral cataract surgery

When a surgeon initially embarks upon SBCS, patients should be carefully selected, simply avoiding expected difficult cases. Patients at significantly increased risk of infection, or with significant corneal (e.g. Fuchs' dystrophy, corneal scarring), lenticular (e.g. subluxulation, very dense cataracts), or retinal abnormalities (e.g. diabetic retinopathy, severe peripheral lattice degeneration, high myopia, postvitrectomy) are generally excluded, as are those who may not be able to cooperate because of language problems, tremor, personality, or dementia.

Once comfortable with SBCS, exclusions progressively decrease, and sometimes potential problem cases (language problems, tremors, etc.) are preferentially performed as SBCS. Furthermore, a patient may present with a moderate cataract in their 'good eye', but a dense cataract in an amblyopic eye, which they chose to ignore previously, rather than go through UCS 'for no significant benefit'. However, once the better eye is being done, surgery in the amblyopic eye, as a 'bonus add-on', will restore a full visual field, and sometimes surprisingly good acuity, without the stress of an additional operating session.

Mandatory complete and strict asepsis

Complete and strict asepsis is mandatory [13]. We feel strongly that if SBCS cannot be performed with complete sterile separation of the two eyes, it should not be done, as failure to aseptically isolate the two eye surgeries may result in devastating bilateral endophthalmitis, of which four have been reported to date. No cases of bilateral endophthalmitis have been reported in which complete sterile guidelines were followed.

It is generally accepted that the patient should receive a topical antibiotic (usually a 4th generation fluoroquinolones) and 5% povidone iodine drops to reduce the risk of postoperative endophthalmitis, a nonsteroidal anti-inflammatory to decrease the risk of postoperative cystoid macular edema (CME) and inflammation, in addition to various dilating agents. Povidine–iodine 10% is applied to the skin of the eyelids, nose, and forehead of the operative eye just before surgery. We believe that it is important to list details such as IOL type, power and astigmatism axis, and amount for right and left eyes on an OR board, visible to all during the procedure, preventing right–left errors (Fig. 1). Nurses and staff should be taught to understand and review IOL calculations on the patient chart, and to recite them as the IOL is handed from person to person. Everyone who handles the IOL must accept responsibility to assure accuracy. The eye drape is changed after the first eye surgery, and the doctor and nurse(s) change their gloves. Separation of right and left OR tables is mandatory with strict avoidance of cross-contamination. We always

Figure 1 Intraoperative set-up for simultaneous bilateral cataract surgery (SBCS)

The left eye is performed first, with the right eye tray far removed from the left eye tray. Details, such as IOL power and astigmatism, are posted on the operating room board for all to cross-check. Inset: Nurse and staff do not handle second eye tray until first eye is completed and gloves have been changed. IOL, intraocular lens.

perform surgery on the left eye first, ensuring a consistent routine, and because it is easier for us, in the design of our operating room, to stay away from the right eye table, than the left eye table. A completely different set of sterile instruments is used for the second eye, as well as different balanced salt solutions (BSS) and ophthalmic viscosurgical devices (OVD) from a different lot and preferably a different manufacturer. We avoid changing scrub nurses during a procedure, but encourage it between left and right eyes. Intracameral antibiotics, preferably moxifloxacin 100 μg in 0.1 ml BSS, are routinely used as the final step for each eye surgery (Table 3).

Upon completion of SBCS, patches are not used as quick visual rehabilitation and stereopsis are prominent advantages of SBCS versus UCS, and postoperative eye drops are begun immediately. We use topical anesthesia with intracameral 1% isotonic nonpreserved xylocaine (Astra polyamps). Postoperatively we use moxifloxacin 0.5% (Vigamox, Alcon Laboratories), prednisolone acetate 1% (Pred Forte, Allergan), and ketorolac tromethamine 0.5% (Acular, Allergan) six times daily for the first 3 days, followed by q.i.d. until all the bottles are empty. Different bottles are used for each eye, marked as such and taped together as right and left eye drops. Postoperative examination is performed on day 1 (POD1), then between 7 and 12 days later as determined by scheduling issues.

Complications following simultaneous bilateral cataract surgery

The most common fear of bilateral surgery is that of devastating complications such as bilateral endophthalmitis. These fears seem unfounded on the basis of complication rates reported in peer-reviewed literature. Table 4 summarizes unilateral complication rates reported in three bilateral ECCE and three bilateral phacoemulsification series for a total of 4152 eyes, whereas Table 5 illustrates the bilateral complications in the same series. Other series did not report all complications, but restricted discussion to the selected ones. Packard [18] reported on SBCS in 506 patients, with the most serious complications cited as three posterior capsule ruptures and one case of culture-negative endophthalmitis in 1012 eyes.

Table 4 Unilateral complications with simultaneous bilateral cataract surgery

	Beatty ($n=638$), ECCE, GA	Ramsay ($n=528$), 453 ECCE/60, phaco	Sharma ($n=288$), ECCE ACM, GA	Wertheim ($n=218$), Phaco, T/IC	Arshinoff ($n=2040$), Phaco, T/IC	Johansson ($n=440$), Phaco, T
Intraoperative						
Hole in PC	5 (0.8)	10 (1.9)	2 (0.69)	0 (0)	3 (0.15)	3 (0.7)
Hole + vitreous loss	2 (0.3)	16 (3.0)	3 (1.04)	1 (0.5)	1 (0.05)	1 (0.2)
Hyphema	5 (0.8)	18 (3.5)	–	–	1 (0.05)	–
Total intraoperative	12 (1.9)	44 (8.3)	5 (1.7)	1 (0.5)	5 (0.25)	4 (0.9)
Postoperative						
Wound leak	2 (0.3)	1 (0.2)	1 (0.35)	–	2 (0.1)	–
Retinal detachment	0 (0)	1 (0.2)		0 (0)	4 (0.2)	–
Ciliary block glaucoma	–	–	–	–	1 (0.05)	–
IOP >22 mmHg	19 (3.0)	15 (2.9)	11 (3.82)	4 (1.8)	–	2 (0.5)
Endothelial decompensation	–	7 (1.4)	–	–	1 (0.05)	–
Iritis, uveitis	9 (1.4)	10 (1.9)	2 (0.69)	1 (0.5)	8 (0.39)	6 (1.3)
Transient CME	12 (1.9)	2 (0.4)	2 (0.69)	3 (1.4)	6 (0.29)	2 (0.5)
IOL power error >0.75D	–	–	–	15 (6.9)	5 (0.25)	1 (0.2)
IOL dislocation	–	–	1 (0.35)	–	–	–
Endophthalmitis	1 (0.15)	1 (0.2)	0 (0)	0 (0)	0	2 (0.5)
Total postoperative	43 (6.7%)	37 (7.0%)	17 (5.9%)	23 (10.6%)	27 (1.32%)	13 (3.0%)
Total intraoperative + postoperative	55 (8.6%)	81 (15.3%)	22 (7.6%)	24 (11.0%)	32 (1.57%)	17 (3.9%)

ACM, anterior chamber maintainer; CME, cystoid macular edema; ECCE, extracapsular cataract extraction; GA, general anesthesia; IOL, intraocular lens; n, number of eyes, (%); PC, posterior capsule; T/IC, topical and intracameral anesthesia.

The most common unilateral complications in the phacoemulsification cases are inflammatory, including uveitis and iritis (0.4–1.3%) and transient CME (all <0.5%). Arshinoff *et al.* [13] reported that the addition of the nonsteroidal anti-inflammatory drug ketorolac tromethamine q.i.d. for 3 weeks to the postoperative medication routine dramatically reduced the incidence of clinically significant CME and iritis in his series. The most common bilateral complications, in the phacoemulsification series, were CME (0.2%) and refractive error (0.2%). There were no bilateral cases of endophthalmitis in any of the ECCE or phacoemulsification series.

Endophthalmitis

Although surgeons cite potential bilateral endophthalmitis as the reason for not offering SBCS to their patients, the reported rates of unilateral endophthalmitis following SBCS have been comparable to, or lower than, those reported after UCS, and has not occurred when full precautions have been taken. The ESCRS study of prophylaxis of postoperative endophthalmitis demonstrated that intracameral antibiotics reduce the rate of endophthalmitis by 80% [31]. Although they used intracameral cefuroxime, the study did not address the issue of the best drug. Arshinoff has used intracameral moxifloxacin in over 2500 eyes, and believes it to be the safest and most effective prophylactic agent [32••,33]. We believe that if one undertakes SBCS, one should include intracameral antibiotic prophylaxis as routine. (Figure 2 contains the method of preparation and use of intracameral moxifloxacin.) Although intracameral antibiotics are common in Europe, most American surgeons prefer postoperative topical fluoroquinolones, and do not use intracameral antibiotics. However, 82% would do so if a reasonably priced commercial preparation was available [33].

Table 5 Bilateral complications with simultaneous bilateral cataract surgery

	Beatty ($n=319$), ECCE	Ramsey ($n=259$), ECCE	Sharma ($n=144$), ECCE	Wertheim ($n=139$), phaco	Arshinoff ($n=1020$), phaco	Johansson ($n=220$), phaco
Endophthalmitis	0	0	0	0	0	0
CME	0	0	0	1 (0.9)	1 (0.1)	1 (0.5)
Uveitis	1 (0.3)[a]	2 (0.8)	0	–	–	–
Refractive error	–	–	–	2 (1.8)	1 (0.1)	–
Corneal edema	–		0	–	–	1 (0.5)
Hyphaema	1 (0.3)	4 (1.5)	–	–	–	–
IOP > 22 mgHg	2 (0.6)	3 (1.2)	0	2 (1.8)	–	–
Capsule block syndrome	–	–	–	1 (0.9)	–	–
Striate keratopathy	2 (0.6)	–	–	–	–	–
Mixed[b]	–	7 (2.7)	–	–	–	–
Total % of total cases	6 (1.9%)	17 (6.6%)	0 (0%)	6 (4.3%)	2 (0.2%)	2 (1%)

CME, cystoid macular edema; ECCE, extracapsular cataract extraction; n, number of patients; phaco, phacoemulsification.
[a] Chronic uveitis, not reported.
[b] Bilateral complications of a different type in each eye.

Figure 2 Intracameral Vigamox (moxifloxacin HCl 0.5%)

Supplied as vigamox eye drops = 500μg / 0.1 ml

I use vigamox in one of 2 ways:
1. 0.2 ml of vigamox 50 μg / 0.1 ml at the end of each case or:
2. 0.1 ml of vigamox 100 μg / 0.1 ml at the end of each case. (preferred method)

To get: 100 μg / 0.1 ml: simply dilute eye drops 5:1
50 μg / 0.1 ml = 10:1 dilution.

To make it up:
1. 50 μg / 0.1 ml:
   a. 1 ml vigamox withdrawn into 10 ml syringe with sterile needle from new bottle.
      - no millipore filter needed.
      9 ml BSS drawn into syringe from new 25 ml BSS bottle.
   b. Syringe mixed by rotating in hands.
   c. ½ ml placed in medicine cup per case, by circulating nurse, and scrub nurse draws up 0.3 ml in TB syringe (you have enough for 20 cases).
   d. 0.2 ml injected via side port into capsular bag, under capsulorhexis edge remote from side port, then washed through AC as cannula is withdrawn.
      - if syringe is filled by scrub nurse to exactly 0.3 ml, after you get the "feel" for the necessary travel of the barrel, exactly 0.2 ml becomes easy to inject and pressurize the eye.
2. 100 μg / 0.1 ml (preferred method)
   a. 2 ml vigamox withdrawn into 10 ml syringe with sterile needle from new bottle.
   b. 8 ml BSS drawn into syringe, from new 25 ml BSS bottle, mixed as above, & distributed in same way. 0.5 ml placed in medicine cup by circulator, per case.
   c. Scrub nurse draws up 0.3 ml in TB syringe to hand to surgeon (extra allows for loss in cannula, etc).
   d. Surgeon injects it through side port as the last step of surgery, under the distal capsulorhexis edge and then rapidly exits the eye, making sure to keep the eye pressurized.

I have done 350 cases with 50 μg/0.1 ml, and 2,500+ cases with 100 μg/0.1 ml. I prefer the second method. (Aug. 2008) Steve Arshinoff MD FRCSC

There is a group of prominent SBCS surgeons who jointly conduct a SBCS course at the annual ASCRS and ESCRS meetings. These surgeons have recently founded the International Society of Bilateral Cataract Surgeons (ISBCS), with a website at www.iSBCS.org. They presented their endophthalmitis data at the 2008 ASCRS meeting in Chicago, with 0 cases of bilateral endophthalmitis, and 10/33 000 cases of unilateral endophthalmitis, for an incidence of 0.03%, less than half the frequency of the cefuroxime-treated arm of the ESCRS endophthalmitis study (Table 6) [2,25••,31,34••–38••].

There have been four case reports of bilateral endophthalmitis following SBCS in the literature since 1952. All were caused by incomplete sterile technique. There have been no reported cases of bilateral endophthalmitis after SBCS when complete sterile separation of the two procedures has been followed [13].

(1) 1978 Malawi (Benezra and Chirambo) [2]. The patient had septicemia and dysentery. Both eyes were operated with the same instruments using ICCE, with resulting bilateral blindness.
(2) 2005 Turkey (Ozdek *et al.*) [39]. A 70-year-old healthy male underwent SBCS using phacoemulsification. The surgeon used a new drape, flashed the same instruments, and did not institute any antibiotic prophylaxis. In addition, the same phacoemulsification tip

Table 6 Postop endophthalmitis cases of simultaneous bilateral cataract surgery surgeons presented at ASCRS SBCS course 2008

			Endophthalmitis cases	
Surgeon	Location	Total eyes	Unilateral	Bilateral
Steve Arshinoff	Toronto, Canada	>6000	0	0
Charles Claoué	London, England	~1000	0	0
Richard Packard	London, England	750	0	0
John Bolger	London, England	>6600	3	0
Sulevi Kaipiainen	Joensuu, Finland	>12 000	2	0
Johann Kruger	Cape Town, South Africa	~7000+	5	0
Total		~33 000+10	0	

Overall incidence = 10/33 000 = 1/3300 = 0.03% unilateral 0.00% bilateral (Cefuroxime arm of ESCRS study = 1/1400 = 0.07%).

and fluids were used. BCVA recovered to 20/50 OD and 20/40 OS after 1 month.

(3) 2007 Iran (Kashkouli *et al.*) [40]. A 67-year-old male underwent SBCS with one eye receiving a foldable IOL after phacoemulsification and the second an unplanned ECCE and 6 mm PMMA IOL. The same instruments were used for both eyes resulting in bilateral blindness from *Pseudomonas aeruginosa*. Another patient of the same surgeon who also underwent SBCS acquired endophthalmitis with the same organism in one eye the preceding day.

(4) 2008 UK (Puvanachandra and Humphry) [41]. An 81-year-old female who underwent SBCS using different instruments from the same sterilization cycle. The patient was rescrubbed and re-drapped, and new irrigation fluid was used. Acrylic IOLs were implanted and intracameral cefuroxime was administered. Postoperatively topical tobramycin was administered. *Staphylococcus epidermidis* sensitive to gentamicin, ciprofloxacin, and vancomycin was cultured from both eyes. The patient recovered 6/9 acuity OU.

The last case (Puvanachandra and Humphry) raises a number of concerns. Why were instruments used from the same sterilization cycle? Were they flashed, or did they go through a full cycle? Were diamond or metal blades used? Was there incisional leakage? Postoperative endophthalmitis is increased with the use of clear corneal incision (CCI) versus scleral tunnel, but appears to be as a result of poor wound architecture, and it remains clear that with proper aseptic technique, proper CCI construction, and sealing, the risk of endophthalmitis remains acceptably low [42]. What was the source of the infecting organism(s)? Was it the same bacterium in both eyes? Although this case seems to have been managed with a higher standard of sterility than previous bilateral endophthalmitis cases, complete sterile separation of the two eyes still did not occur, and other procedural problems seem to be present, emphasizing the need for extreme caution with SBCS.

Toxic anterior segment syndrome

Although there are no reported cases of toxic anterior segment syndrome (TASS) after SBCS, a recent study by Kim *et al.* [22] highlights a case of bilateral TASS after second eye cataract surgery was performed 1 day after the first eye surgery. There is increasing concern about TASS, as anything that enters the eye can cause it. Care is required when substituting any new product into a surgical protocol, as many devices and drugs, including generic versions of BSS, vancomycin, rough finish IOLs, enzymatic detergent cleaners, and reused improperly cleaned OVD cannulas have caused TASS. In addition, short-cut procedural steps, such as rolling the IOL in the surgeon's glove to facilitate implantation, can contribute to TASS, as can any change in operative protocol [43].

Retinal detachment

In our series of 1020 consecutive patients undergoing SBCS, four patients developed retinal detachment from 2 months to more than 3 years postoperatively [13]. Even if the patient had undergone two separate UCS procedures, these patients would have undergone second eye surgery before the detachments developed. All of our patients with retinal detachment possessed known risk factors listed in Table 7. Retinal detachment appears to be a risk factor of UCS, and not significantly affected by SBCS.

Postoperative refractive error due to inaccurate biometric assessment

In our series of 1024 SBCS patients using phacoemulsification from 1996 to 2002, only five eyes had significant IOL power errors (>0.75D), of which three were extreme hyperopes and two were high myopes with foveas on the slope of posterior staphylomas [13]. Since then, IOL calculation accuracy has been greatly enhanced by partial

Table 7 Recognized risk factors for development of retinal detachment

Age <60
Male
Caucasian
Myopes with axial length >24.00 mm
Previous RD or myopic retinal changes (extensive lattice degeneration)
Marfan's syndrome
Post Nd:YAG capsulotomy
Intraoperative vitreous loss

RD, retinal detachment; Nd:YAG, neodymium yttrium aluminium garnet.

coherence interferometry, with the Zeiss IOL Master, and newer equations, essentially resolving the issue of IOL power errors, except in opaque cataracts and post-refractive surgery eyes. The ASCRS website Post-Refractive Surgery IOL Calculator has greatly reduced the error in calculations for these patients (http://iol.ascrs.org/). Furthermore, Jabbour *et al.* [44] have shown that there is no advantage to reassessing IOL calculations between the first and second eye surgeries of a patient in an attempt to improve IOL accuracy. There is, therefore, little to be gained, with respect to refractive error prediction, from UCS × 2, over SBCS [45].

Bilateral cystoid macular edema

Bilateral clinically significant CME after SBCS rates in the literature range from 0.1 to 0.9% with phacoemulsification (Table 5), which compares to the reported rates after UCS of 0.8–1.2% [45]. Although clinically significant CME is always a concern, it has not emerged as a significant problem among the presenters at the ASCRS SBCS course in 2008, representing about 33 000 consecutive cases, or in the published literature. Prophylactic administration of topical NSAIDs in the perioperative period seems advisable [13].

Bilateral corneal decompensation

Although preoperative pachymetry and careful slit lamp exam of the endothelium should pick up significant bilateral endothelial abnormality, and techniques have been described to minimize BSS turbulence affecting the corneal endothelium, bilateral corneal decompensation has occurred, although very rarely. MacDonnell reports one case following SBCS, but the circumstances of the case and prophylactic measures taken during surgery are not known [8,46,47].

Advantages of simultaneous bilateral cataract surgery

Modern cataract surgery usually takes about 10–20 min under topical anesthesia. Performing surgery on half as many patients per day simplifies the jobs of all concerned, including booking, registration, nursing, surgeon, anesthetist, patients, and their families. Patient preference and convenience are overwhelming considerations in modern society, and many surgeons cite patient preference as their chief reason to offer SBCS. It is preferred by busy professionals and for those traveling long distances to cataract centers who wish to save time and money.

In any patient requiring general anesthesia or juggling the patient's systemic medications perioperatively, SBCS clearly has advantages.

In our experience, most SBCS patients experience reduced stress and more rapid recovery of stereopsis and fully functional vision, usually returning to driving and normal life on POD1. In a randomized clinical study, Lundstrom reported that the rapid rehabilitation of the visual system, achieved almost immediately after SBCS, was not replicated in UCS procedures until the 4-month postoperative assessment after the second eye surgery. He also reports that UCS patients had significantly more difficulty performing daily life activities for the intervening period. First eye cataract surgery significantly reduces the rates of falling in elderly women, improving visual function and general health status. Although Foss *et al.* [48,49] tried to extend these data to second eye surgery, numbers were not large enough to be conclusive despite trends showing reduced falls and better visual performance.

SBCS allows patients to avoid postoperative anisometropia and reduced binocularity in the interprocedural period [50]. SBCS allows better planning of the postoperative refractive state, whether correcting high refractive orders, inducing monovision, or adapting to multifocality [18].

Barriers to practicing simultaneous bilateral cataract surgery

A number of new, surprising barriers have arisen concerning SBCS.

Conflict with preferred practice patterns

Although many surgeons acknowledge the advantages inherent in practicing SBCS, most do not offer it, citing concern for legal liability, as SBCS is not mentioned as 'standard of care' in the 'preferred practice pattern' (PPP) documents of most countries, except Finland [25••]. PPP documents cite current accepted practices. It is, by definition, impossible for anything 'new' to be consistent with current practice. It is either current practice, and therefore not new, or new, and therefore not current practice. A review of both United States (AAO PPP) and British (Royal College of Ophthalmologists Cataract Surgery Guidelines) reveal a gradual progressive acceptance of SBCS into the main stream over the past decade, although both groups still do not consider it 'the standard of care'. In 2006, for the first time, the AAO PPPs included a separate discussion of SBCS in their updated PPP and stated that if SBCS is being considered the patient must be carefully informed of potential disadvantages, and still did not support routine SBCS [51]. The 2007 Royal College of Ophthalmologists (UK) Cataract Surgery Guidelines (www.rcophth.ac.uk/pdf/cataract.pdf) include indications for SBCS, state that strict aseptic precautions must be taken, and do not argue against it. Unlike the Royal College of Ophthalmologists Surgery Guidelines, the AAO PPPs do not include relative indications for SBCS, although they do list indications reported in the literature, such as the need for general anesthesia in the presence of

visually significant cataracts and those times when travel for surgery and follow-up care is a significant hardship for the patient.

We firmly believe that SBCS is better for patients, and that 'it is the responsibility of all those following the path of innovation, not to do what is current practice, but to do better than common current practice, and to work to demonstrate the superiority of new techniques. Without this, science and medicine can never progress' [23].

Financial disincentives to performing bilateral cataract surgery

Although physician greed has been cited as a reason why surgeons adopt SBCS, in fact, both physicians and anesthesiologists almost universally receive a reduced remuneration for the second eye in SBCS up to 100% reduction in some jurisdictions. SBCS is more common in which financial penalties are less [24].

Simultaneous bilateral cataract surgery in the developing world

Several questions relating to the practice of SBCS in developing countries with respect to infrastructure, follow-up, administration of eye drops, and so on have been raised. It may be easier to do both eyes at once and keep the patient around for a few days of close monitoring, than to try to do the eyes separately under less close supervision. Jhanji *et al.* [52] cite the advantages of performing SBCS in a high volume tertiary care center in India, including not losing patients to follow-up, decreased incidence of phacomorphic glaucoma in the unoperated eye, and decreased waiting times at their center. However, financial considerations remain the main deterrent, including the inability of uninsured patients to afford bilateral IOLs. Of 50 patients surveyed at their center, almost 50% cited financial reasons for not considering SBCS.

Conclusion

Although still controversial, the practice of SBCS is becoming accepted and more frequent in its sixth decade. With vastly improved modern technology offering extremely rapid recovery and favorable complication rates compared to unilateral surgery, SBCS offers many advantages, improving quality of life for our patients. SBCS increases surgical efficiency, benefiting both patients and health systems. Nevertheless, political structures are slow to adapt, and financial disincentives have prevented its wider adoption. For the experienced surgeon with a low complication rate, SBCS provides an option which will be greatly appreciated by their patients, and will likely become the standard in the future, especially with the gradual move to refractive lens exchanges in presbyopic, and ametropic patients.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

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