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Different-sized incisions for phacoemulsification in age-related cataract (Review)

Jin C, Chen X, Law A, Kang Y, Wang X, Xu W, Yao K

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[Intervention Review]

Different-sized incisions for phacoemulsification in age-related cataract

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ABSTRACT

Background

Age-related cataract is the principal cause of blindness and visual impairment in the world. Phacoemulsification is the main surgical procedure used to treat cataract. The comparative effectiveness and safety of different-sized incisions for phacoemulsification has not been determined.

Objectives

The aim of this systematic review was to assess the effectiveness and safety of smaller versus larger incisions for phacoemulsification in age-related cataract. The primary outcome of this review was surgically induced astigmatism at three months after surgery.

Search methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL) (which contains the Cochrane Eyes and Vision Trials Register) (2016, Issue 10), MEDLINE Ovid (1946 to 28 October 2016), Embase Ovid (1947 to 28 October 2016), PubMed (1948 to 28 October 2016), LILACS (Latin American and Caribbean Health Sciences Literature Database) (1982 to 28 October 2016), the *metaRegister of Controlled Trials* (*mRCT*) (www.controlled-trials.com; last searched 13 May 2013), ClinicalTrials.gov (www.clinicaltrials.gov; searched 28 October 2016), and the WHO International Clinical Trials Registry Platform (ICTRP) (www.who.int/ictpr; searched 28 October 2016). We did not use any date or language restrictions in the electronic searches for trials.

Selection criteria

We included randomized controlled trials (RCTs) comparing different-sized incisions in people with age-related cataract undergoing phacoemulsification.

Data collection and analysis

We used standard methodological procedures expected by Cochrane.

Main results

We included 26 RCTs with a total of 2737 participants (3120 eyes). These trials were conducted in Bosnia and Herzegovina, China, France, India, Italy, Korea, Spain, Switzerland, and Turkey. Half of the 26 trials were conducted in China. We judged all trials as mostly at unclear to

low risk of bias. The included RCTs compared four different-sized incisions: ≤ 1.5 mm, 1.8 mm, 2.2 mm, and approximately 3.0 mm. These incisions were performed using three different techniques: coaxial and biaxial microincision phacoemulsification (C-MICS and B-MICS) and standard phacoemulsification. Not all studies provided data in a form that could be included in this review. Five studies had three arms.

Fifteen trials compared C-MICS (2.2 mm) with standard phacoemulsification (about 3.0 mm). Very low-certainty evidence suggested less surgically induced astigmatism in the C-MICS group at three months compared with standard phacoemulsification (mean difference (MD) -0.19 diopters (D), 95% confidence interval (CI) -0.30 to -0.09; 996 eyes; 8 RCTs). There was low-certainty evidence that both groups achieved similar best-corrected visual acuity (MD 0.00 logMAR, 95% CI -0.02 to 0.02; 242 eyes; 3 RCTs). There was low-certainty evidence of little or no difference in endothelial cell loss and central corneal thickness comparing C-MICS with standard phacoemulsification (MD -7.23 cells/mm², 95% CI -78.66 to 64.20; 596 eyes; 4 RCTs) and (MD -0.68 μ m, 95% CI -3.26 to 1.90; 487 eyes; 5 RCTs).

Nine trials compared C-MICS (1.8 mm) with standard phacoemulsification (about 3.0 mm). Very low-certainty evidence suggested less astigmatism at three months in the C-MICS group compared with standard phacoemulsification group (MD -0.23 D, 95% CI -0.34 to -0.13; 561 eyes; 5 RCTs). Low-certainty evidence suggested little or no difference in best-corrected visual acuity, endothelial cell loss, and central corneal thickness in the two groups at three months (MD -0.02 logMAR, 95% CI -0.03 to -0.00; 192 eyes; 3 RCTs), (MD 7.56 cells/mm², 95% CI -67.65 to 82.77; 380 eyes; 5 RCTs), and (MD -1.52 μ m, 95% CI -6.29 to 3.25; 245 eyes; 3 RCTs).

Six studies compared C-MICS (1.8 mm) with C-MICS (2.2 mm). There was low-certainty evidence that astigmatism, visual acuity, and central corneal thickness were similar in the two groups at three months (MD 0.04 D, 95% CI -0.09 to 0.16; 259 eyes; 3 RCTs), (MD 0.01 logMAR, 95% CI -0.01 to 0.04; 200 eyes; 3 RCTs), and (MD 0.45 μ m, 95% CI -2.70 to 3.60; 100 eyes; 1 RCT). Very low-certainty evidence suggested higher endothelial cell loss in the 1.8 mm group (MD 213.00 cells/mm², 95% CI 11.15 to 414.85; 70 eyes; 1 RCT).

Four studies compared B-MICS (≤ 1.5 mm) with standard phacoemulsification (about 3.0 mm). Astigmatism was similar in the two groups at three months (MD -0.01 D, 95% CI -0.03 to 0.01; 368 eyes; 2 RCTs; moderate-certainty evidence). There was low-certainty evidence on visual acuity, suggesting little or no difference between the two groups (MD -0.02 logMAR, 95% CI -0.04 to -0.00; 464 eyes; 3 RCTs). Low-certainty evidence on endothelial cell loss and central corneal thickness also suggested little or no difference between the two groups (MD 55.83 cells/mm², 95% CI -34.93 to 146.59; 280 eyes; 1 RCT) and (MD 0.10 μ m, 95% CI -14.04 to 14.24; 90 eyes; 1 RCT).

None of the trials reported on quality of life. One trial reported that no participants experienced endophthalmitis or posterior capsule rupture; they also reported little or no difference between incision groups regarding corneal edema (risk ratio 1.02, 95% CI 0.40 to 2.63; 362 eyes).

Authors' conclusions

Phacoemulsification with smaller incisions was not consistently associated with less surgically induced astigmatism compared with phacoemulsification with larger incisions. Coaxial microincision phacoemulsification may be associated with less astigmatism than standard phacoemulsification, but the difference was small, in the order of 0.2 D, and the evidence was uncertain. Safety outcomes and quality of life were not adequately reported; these should be addressed in future studies.

PLAIN LANGUAGE SUMMARY

Different-sized incisions for cataract surgery in people with age-related cataract

Review aim

The aim of this Cochrane Review was to find out if the size of the incision (cut in the eye) during cataract surgery results in a difference in outcome of cataract surgery. We found 26 studies that answered this question.

Key messages

Some, but not all, surgical techniques using smaller incisions were associated with less astigmatism; however, the differences were small and the evidence was uncertain. There was little evidence to suggest any important effects on vision. There were limited data on adverse effects and no evidence on the effects of different-sized incisions on quality of life.

What was studied in this review?

As people age the clear lens in the eye can become cloudy, which is known as a cataract. An operation can be performed to remove the cataract and replace the cloudy lens with a clear artificial lens. This surgery is safe and restores sight in almost all cases. Age-related cataract is one of the leading causes of blindness worldwide.

One problem that can occur after cataract surgery is that due to the surgery the front of the eye is no longer a perfectly curved shape. This can result in blurred or distorted vision and is known as astigmatism. The vision problems arising from astigmatism can be corrected with spectacles. It is commonly believed that the smaller the cut or incision made in the eye during cataract surgery, the less chance of astigmatism.

Key results

We searched for studies that compared different-sized incisions for cataract surgery in people with age-related cataract. This review includes 26 studies from Europe and Asia.

We found the following results.

- Some, but not all, surgical techniques using smaller incisions were associated with less astigmatism, however the differences were small and the evidence was uncertain (low- and very low-certainty evidence).
- In general, there may be little or no difference in visual acuity based on whether a smaller or larger incision is made (low-certainty evidence).
- There were no consistent effects on other signs such as thickness of the cornea (front of the eye) and number of cells in the front of the eye (low- and very low-certainty evidence).
- Adverse effects were not reported by most of the included studies.
- None of the studies reported on the quality of life of participants.

How up-to-date is this review?

We searched for studies published up to 28 October 2016.

SUMMARY OF FINDINGS

Summary of findings for the main comparison. Larger coaxial microincision cataract surgery (C-MICS) versus standard phacoemulsification

Larger C-MICS compared with standard phacoemulsification for age-related cataract

Patient or population: adults with age-related cataract

Settings: eye clinics

Intervention: larger C-MICS with 2.2-millimeter incision

Comparison: standard phacoemulsification with about 3.0-millimeter incision

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No. of eyes (studies)	Certainty of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Standard phacoemulsification	Larger C-MICS				
Mean postoperative surgically induced astigmatism Follow-up: 3 months	The mean surgically induced astigmatism was 0.7 to 1.34 diopters.	The mean surgically induced astigmatism in the intervention groups was 0.19 diopters lower (0.30 to 0.09 diopters lower).	-	996 (8 RCTs)	⊕⊕⊕⊕ very low ^{a,b}	A lower diopter value is a better clinical outcome.
Mean postoperative best-corrected visual acuity Follow-up: 3 months	The mean best-corrected visual acuity was 0.05 to 0.11 logMAR.	The mean best-corrected visual acuity in the intervention groups was 0.00 logMAR lower (0.02 logMAR lower to 0.02 logMAR higher).	-	242 (3 RCTs)	⊕⊕⊕⊕ low ^c	
Mean endothelial cell loss Follow-up: 3 months	The mean of endothelial cell loss ranged across control groups was 2054.0 to 2339.0 cells/mm ² .	The mean change of endothelial cell loss in the intervention groups was 7.23 cells/mm ² lower (78.66 cells/mm ² lower to 64.20 cells/mm ² higher).	-	596 (4 RCTs)	⊕⊕⊕⊕ low ^d	Little or no difference between groups is a clinically positive result.
Central corneal thickness	The mean change of central corneal thickness was 9.24 μm.	The mean change of central corneal thickness in the interven-	-	487 (5 RCTs)	⊕⊕⊕⊕ low ^d	Hwang 2016 did not report the standard deviation, but reported that

Follow-up: 3 months	The mean central corneal thickness ranged across control groups from 546.0 to 580.0 µm.	tion groups was 0.68 µm lower (3.26 µm lower to 1.90 µm higher).			the mean % decrease in central corneal thickness was 1.00 in the 2.2-millimeter group and 0.31 in the 2.75-millimeter group. Little or no difference between groups is a clinically positive result.
Adverse events (corneal edema) Follow-up: 3 months	46 per 1000	47 per 1000 (19 to 122)	RR 1.02 (0.40 to 2.63)	362 (1 RCT)	Wang 2009 reported "no intraoperative complications."
Quality of life	Not reported				

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval; **RCT:** randomized controlled trial; **RR:** risk ratio

GRADE Working Group grades of evidence

High-certainty: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate-certainty: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low-certainty: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low-certainty: We are very uncertain about the estimate.

^aDowngraded two levels for risk of bias, as one study was at high risk of selection and attrition bias, while another study was at high risk of reporting bias.

^bDowngraded one level for unexplained statistical heterogeneity.

^cDowngraded two levels for risk of bias, as the studies were at unclear risk of selection and attrition bias.

^dDowngraded two levels for risk of bias, as the studies were at unclear risk of selection, performance, detection, and attrition bias.

Summary of findings 2. Smaller coaxial microincision cataract surgery (C-MICS) versus standard phacoemulsification

Smaller C-MICS compared with standard phacoemulsification for age-related cataract

Patient or population: adults with age-related cataract

Settings: eye clinics

Intervention: smaller C-MICS with 1.8-millimeter incision

Comparison: standard phacoemulsification with about 3.0-millimeter incision

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No. of eyes (studies)	Certainty of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Standard phacoemulsification	Smaller C-MICS				
Mean postoperative surgically induced astigmatism Follow-up: 3 months	The mean postoperative surgically induced astigmatism ranged across control groups from 0.03 to 0.94 diopters.	The mean postoperative surgically induced astigmatism in the intervention groups was 0.23 lower (0.34 diopters to 0.13 diopters lower).	-	561 (5 RCTs)	⊕⊕⊕⊕ very low ^{a,b}	A lower diopter value is a better clinical outcome.
Mean postoperative best-corrected visual acuity Follow-up: 2 to 3 months	The mean postoperative best-corrected visual acuity ranged across control groups from 0.05 to 0.06 logMAR units.	The mean postoperative best-corrected visual acuity in the intervention groups was 0.02 logMAR units lower (0.03 logMAR units lower to 0.00 logMAR units).	-	192 (3 RCTs)	⊕⊕⊕⊕ low ^c	
Mean change of endothelial cell loss Follow-up: 3 months	The mean change of endothelial cell loss ranged across control groups from 2231.22 to 3077.0 cells/mm ² .	The mean change of endothelial cell loss in the intervention groups was 7.56 cells/mm ² higher (67.65 cells/mm ² lower to 82.77 cells/mm ² higher).	-	380 (5 RCTs)	⊕⊕⊕⊕ low ^a	
Mean change of central corneal thickness Follow-up: 3 months	The mean change of central corneal thickness ranged across control groups from 3.74 to 63.5 μm.	The mean change of central corneal thickness in the intervention groups was 1.52 μm lower (6.29 μm lower to 3.25 μm higher).	-	245 (3 RCTs)	⊕⊕⊕⊕ low ^a	
Adverse events Follow-up: 3 months	None of the trials reported on adverse events.					
Quality of life	Not reported					

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval; **RCT:** randomized controlled trial

GRADE Working Group grades of evidence

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Moderate-certainty: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low-certainty: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low-certainty: We are very uncertain about the estimate.

^aDowngraded two levels for high risk of selection, performance, and detection bias.

^bDowngraded two levels for unexplained statistical heterogeneity, as the I^2 was greater than 70%.

^cDowngraded two levels for unclear risk of selection, performance, detection, attrition, and reporting bias.

Summary of findings 3. Smaller coaxial microincision cataract surgery (C-MICS) versus larger C-MICS

Smaller coaxial microincision cataract surgery (C-MICS) compared with larger C-MICS for age-related cataract

Patient or population: adults with age-related cataract

Settings: eye clinics

Intervention: smaller C-MICS with 1.8-millimeter incision

Comparison: larger C-MICS with 2.2-millimeter incision

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No. of eyes (studies)	Certainty of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Larger C-MICS	Smaller C-MICS				
Mean postoperative surgically induced astigmatism Follow-up: 3 months	The mean postoperative surgically induced astigmatism ranged across control groups from 0.48 to 1.08 diopters.	The mean postoperative surgically induced astigmatism in the intervention groups was 0.04 diopters higher (0.09 diopters lower to 0.16 diopters higher).	-	259 (3 RCTs)	⊕⊕⊕⊕ low ^a	A lower diopter value is a better clinical outcome.
Mean postoperative best-corrected visual acuity Follow-up: 3 months	The mean postoperative best-corrected visual acuity ranged across control groups from -0.06 logMAR units to 0.27 logMAR units.	The mean postoperative best-corrected visual acuity in the intervention groups was 0.01 logMAR units higher (0.01 logMAR units lower to 0.04 logMAR units higher).	-	200 (3 RCTs)	⊕⊕⊕⊕ low ^a	
Mean change of endothelial cell loss	The mean change in endothelial cell loss was 2303.0 cells/mm ² .	The mean change in endothelial cell loss was 213.00 cells/mm ² higher (11.15 to 414.85 cells/mm ² higher).	-	70 (1 RCT)	⊕⊕⊕⊕ very low ^{b,c}	

Follow-up: 3 months					
Mean central corneal thickness	The mean change in central corneal thickness was 2.99 µm.	The mean change in central corneal thickness was 0.45 µm higher (2.70 µm lower to 3.60 µm higher).	-	100 (1 RCT)	⊕⊕⊕⊕ low ^c
Follow-up: 3 months					
Adverse events	None of the trials reported on adverse events.				
Follow-up: end of trial					
Quality of life	Not reported				

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval; **RCT:** randomized controlled trial

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Moderate-certainty: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low-certainty: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low-certainty: We are very uncertain about the estimate.

^aDowngraded two levels for unexplained statistical heterogeneity, as the I² was greater than 70%.

^bDowngraded one level for risk of bias, as the studies were at unclear risk of selection, performance, detection, and attrition bias.

^cDowngraded two levels for imprecision of results, as only one trial reported endothelial cell loss at three months' follow-up and it is possible that the optimal information size has not been reached.

Summary of findings 4. Biaxial microincision cataract surgery (B-MICS) versus standard phacoemulsification

B-MICS compared with standard phacoemulsification for age-related cataract

Patient or population: adults with age-related cataract

Settings: eye clinics

Intervention: B-MICS with equal to or smaller than 1.5-millimeter incision

Comparison: standard phacoemulsification with about 3.0-millimeter incision

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No. of eyes (studies)	Certainty of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				

	Standard phacoemulsification	B-MICS				
Mean postoperative surgically induced astigmatism Follow-up: 3 months	The mean postoperative surgically induced astigmatism ranged across control groups from 0.12 diopters to 0.44 diopters.	The mean postoperative surgically induced astigmatism in the intervention groups was 0.01 diopters lower (0.03 diopters lower to 0.01 diopters higher).	-	368 (2 RCTs)	⊕⊕⊕○ moderate ^a	A lower diopter value is a better clinical outcome.
Mean postoperative best-corrected visual acuity Follow-up: 3 months	The mean postoperative best-corrected visual acuity ranged across control groups from 0.11 logMAR units to 0.97 logMAR units.	The mean postoperative best-corrected visual acuity in the intervention groups was 0.02 logMAR units lower (0.04 logMAR units lower to 0.00 LogMAR units).	-	464 (3 RCTs)	⊕⊕⊕○ low ^b	
Mean endothelial cell loss Follow-up: 3 months	The mean endothelial cell loss in the control groups was 2410 cells/mm ² .	The mean endothelial cell loss in the intervention groups was 55.83 cells/mm ² higher (34.93 cells/mm ² lower to 146.59 cells/mm ² higher).	-	280 (1 RCT)	⊕⊕⊕○ low ^c	
Postoperative central corneal thickness Follow-up: 3 months	The mean change in central corneal thickness in the control group was 546 µm.	The mean change of central corneal thickness in the intervention groups was 0.10 µm higher (14.04 µm lower to 14.24 µm higher).	-	90 (1 RCT)	⊕⊕⊕○ low ^c	
Adverse events Follow-up: end of study	None of the trials reported on adverse events.					
Quality of life	Not reported					

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval; **RCT:** randomized controlled trial

GRADE Working Group grades of evidence

High-certainty: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate-certainty: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low-certainty: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low-certainty: We are very uncertain about the estimate.

^aDowngraded one level for risk of bias, as the trials were at unclear risk of selection and reporting bias.

^bDowngraded two levels for unexplained statistical heterogeneity, as the I^2 was greater than 70%.

^cDowngraded two levels for imprecision, as only one trial reported endothelial cell loss at three months' follow-up and it is possible that the optimal information size has not been reached.

BACKGROUND

Description of the condition

Cataract, or opacification of the lens, is the most common cause of visual impairment worldwide, and poses one of the greatest public health challenges of the 21st century (Asbell 2005; Resnikoff 2004). The opacified lens reduces the light reaching the retina, finally resulting in defective vision. No gender, racial, or ethnic group is immune to age-related opacification of the lens, known as age-related cataract (ARC). Age-related cataract, which constitutes 90% of all cataracts, usually presents in the eyes of people older than 40 years (Schlote 2006). Age-related cataract is divided into three major types, on the basis of slit-lamp examination: nuclear, cortical, and posterior subcapsular (PSC) cataracts. Each of the three can occur alone or in combination, and all of them can progress to total opacification of the lens (Shiels 2010). Density and location of the lens opacity are the two main factors that determine the effect on vision. To date, no method has been confirmed to halt the formation of a cataract lens.

The World Health Organization (WHO) conducted a global review of surveys in 2004 that demonstrated that ARC remained the leading cause of blindness globally, accounting for 48% of world blindness, and that it affected individuals of both high-income and middle- and low-income countries (Resnikoff 2004). Without extra intervention, the global blind population will increase to 76 million in 2020 (Frick 2003). The cataract surgery rate (CSR), the number of cataract operations per million population per annum, is a useful measurement of eye care delivery in different settings; it differs between high-income and middle- and low-income countries.

In Sweden, the CSR was between 8000 and 9000 operations per million population per year from 2000 to 2009 (Behndig 2011), but in Africa the CSR was only about 200 operations per million population per year (WHO 2017). In India about 0.5 million cataract surgeries were performed from 1981 to 1982, but the number had increased to 4.8 million by the year 2006 (Aravind 2008). An even higher increase in the number of cataract surgeries is anticipated in low-income countries under VISION 2020, the global initiative for the elimination of avoidable blindness (Foster 2005). Despite the increasing number of cataract surgeries, ARC continues to be a leading public health issue because of aging populations and increased life expectancies.

Description of the intervention

Currently, surgery to remove the opacification remains the primary and only treatment for ARC. Cataract surgery has changed dramatically over the past 50 years. Among various surgical techniques for cataract management, phacoemulsification using a clear corneal incision has become the gold standard (Kelman 1967). In phacoemulsification, the surgeon uses an ultrasonic handpiece to emulsify the opacified lens and aspirate the consequent small fragments. Compared with earlier cataract surgeries with large invasive incisions and a large postoperative astigmatic error, phacoemulsification requires only a small incision and thus improves surgical outcomes, with fewer intraoperative and postoperative complications and rapid visual rehabilitation. Continuous advancement in instrumentation, techniques, and intraocular lenses (IOLs), to replace the natural lens, has allowed surgeons to use much smaller incision sizes.

The incision of standard phacoemulsifications measures about 3.0 mm in length. This incision size allows the silicone sleeve-covered phacoemulsification handpiece to fit snugly through the surgically induced corneal wound. The covered silicone sleeve is intended to prevent thermal injury to the cornea with the goal of improving effectiveness and safety of phacoemulsification. Two other approaches, coaxial microincision cataract surgery (C-MICS) and biaxial microincision cataract surgery (B-MICS), have been developed (Osher 2007a; Osher 2007b). These procedures allow surgeons to operate through even smaller incisions (Paul 2005). Coaxial microincision cataract surgery allows surgeons to perform irrigation, ultrasound, and aspiration through one incision about 2 mm in length. Biaxial microincision cataract surgery accomplishes irrigation and aspiration separately through two corneal incisions less than 1.5 mm in length (Lam 2009; Weikert 2006). These two approaches may result in intraoperative changes such as the increased use of cumulative dissipated energy (CDE), total use of balanced salt solution (BSS), and prolonged surgical time. To date, Infiniti Vision System (Alcon Laboratories) and Stellaris Vision Enhancement System (Bausch & Lomb) are the two main surgical systems used in the phacoemulsification cataract surgery already described.

How the intervention might work

The goal of cataract surgery is to improve vision by replacing the opacified lens with an artificial intraocular lens called the IOL. After the cataract lens is removed, an IOL is implanted inside the 'bag' of the lens capsule to correct the induced refractive error due to removal of the natural lens. The very small incisions achieved with modern techniques (B-MICS and C-MICS) are expected to lower surgically induced astigmatism (SIA) and allow more rapid visual rehabilitation postoperatively, when compared with current phacoemulsification.

Why it is important to do this review

As phacoemulsification techniques and foldable IOLs have developed rapidly in recent decades, the incision size for phacoemulsification has been reduced from around 3.0 mm with standard phacoemulsification to around 2.0 mm with C-MICS and even smaller - measuring less than 1.5 mm - with B-MICS (Cavallini 2007; Luo 2012). Smaller clear corneal cataract surgical incisions may be associated with better postoperative visual acuity, reduced SIA, improved wound healing, earlier stabilization of refractive error resulting in shorter recovery time, more stable corneal biomechanical properties, and lower risk of endophthalmitis (intraocular infection and inflammation) (Chee 2005). However, B-MICS and C-MICS require more advanced equipment and may result in longer surgical time, increased use of CDE, and consequently greater endothelial cell loss during surgery. An active area of study therefore involves determining the optimal incision size for performance of phacoemulsification. To date, no systematic review of randomized trials has been conducted to assess the effectiveness and safety of incisions of different sizes for phacoemulsification surgery in eyes with age-related cataract.

OBJECTIVES

The aim of this systematic review was to assess the effectiveness and safety of smaller versus larger incisions for phacoemulsification in ARC. The primary outcome of this review was surgically induced astigmatism at three months after surgery.

METHODS

Criteria for considering studies for this review

Types of studies

We included only randomized controlled trials (RCTs) in this review.

Types of participants

We included trials of participants affected by ARC with no ocular condition other than cataract. We included only studies with participants age 50 years or older. Ocular pathologic conditions included high myopia, glaucoma, short axis eyes, etc. We did not impose restrictions with regard to participants' gender or ethnicity.

Types of interventions

We included trials that compared at least two of the following four interventions (major systems included but not limited to Infiniti Vision System and Stellaris Vision Enhancement System).

1. Standard phacoemulsification with about 3.0 mm incision
2. Larger coaxial microincision cataract surgery (C-MICS) with 2.2-millimeter incision
3. Smaller coaxial microincision cataract surgery (C-MICS) with 1.8-millimeter incision
4. Biaxial microincision cataract surgery (B-MICS) with equal to or smaller than 1.5-millimeter incision

We considered standard phacoemulsification with incisions ranging from 2.75 to 3.2 mm to be about 3.0 mm. We excluded trials when the intervention did not meet our inclusion criteria, such as when the initial incision was made on the steepest meridian or expanded for IOL implant, or the manual microincision cataract surgery did not use phacoemulsification to emulsify the opacified lens, etc.

Types of outcome measures

Primary outcomes

1. Mean SIA (in diopters; D) at three months after surgery, measured with corneal topography and assessed by the vector method.

Secondary outcomes

1. Surgically induced astigmatism data when measured at 12 months where clinically important difference is from 0.8 D to 0.1 D.
2. Postoperative best corrected visual acuity (BCVA) on the LogMAR scale at three and 12 months where clinically important difference is 0.1 logMAR units.
3. Postoperative changes of endothelial cell loss (ECL) and central corneal thickness (CCT), from measurements made preoperatively and at three and 12 months after surgery, where little or no difference between baseline and follow-up is clinically advantageous outcome. Endothelial cell loss measured with non-contact specular microscopy (cell/mm² or percentage decrease) and mean CCT measured with ultrasonic pachymeter (μm or percentage increase).
4. Intraoperative parameters recorded at the end of surgery, which are indicative of surgical skill; a lower value is interpreted as having higher surgical skill. The intraoperative parameters are:

- a. use of cumulative dissipated energy is the percentage of power utilized during the ultrasound period (CDE, %);
 - b. total use of balanced salt solution (BSS, mL);
 - c. surgical time (minutes);
 - d. phacoemulsification time (seconds).
5. Postoperative and intraoperative complications, including endophthalmitis, posterior capsule rupture (PCR), etc.
 6. Quality of life as measured by any validated instruments at three and 12 months.

Follow-up

We considered outcomes at three months and one year after surgery. As studies may not report outcomes at precisely these time points, we defined the following time periods.

1. Three months: from four weeks to less than six months
2. Twelve months: from six months to less than 18 months

Search methods for identification of studies

Electronic searches

The Cochrane Eyes and Vision Information Specialist conducted systematic searches in the following databases for RCTs and controlled clinical trials. There were no language or publication year restrictions. The date of the search was 28 October 2016.

- Cochrane Central Register of Controlled Trials (CENTRAL; 2016, Issue 10) (which contains the Cochrane Eyes and Vision Trials Register) in the Cochrane Library (searched 28 October 2016) ([Appendix 1](#))
- MEDLINE Ovid (1946 to 28 October 2016) ([Appendix 2](#))
- Embase Ovid (1947 to 28 October 2016) ([Appendix 3](#))
- PubMed (1948 to 28 October 2016) ([Appendix 4](#))
- LILACS (Latin American and Caribbean Health Sciences Literature Database (1982 to 28 October 2016) ([Appendix 5](#))
- metaRegister of Controlled Trials (mRCT) (www.controlled-trials.com; last searched 13 May 2013) ([Appendix 6](#))
- US National Institutes of Health Ongoing Trials Register ClinicalTrials.gov (www.clinicaltrials.gov; searched 28 October 2016) ([Appendix 7](#))
- World Health Organization International Clinical Trials Registry Platform (www.who.int/ictpr; searched 28 October 2016) ([Appendix 8](#))

Searching other resources

We searched the references of included studies for additional relevant studies, without restriction in terms of language or date of publication.

Data collection and analysis

Selection of studies

Two review authors independently reviewed the titles and abstracts identified through the electronic and manual searches. We classified the titles and abstracts as 'definitely include,' 'unsure,' or 'definitely exclude.' We retrieved full-text articles for those classified as 'definitely include' or 'unsure' and reassessed them according to the inclusion criteria of the review. We consulted a third review author whenever disagreements arose.

For non-English and non-Mandarin articles, we used Cochrane worldwide resources to identify translators for specific languages. All publications from studies meeting the inclusion criteria underwent assessment for risk of bias and data extraction. We contacted the authors of articles to obtain further information as needed. We excluded studies classified as 'definitely exclude' after full-text retrieval, and recorded reasons for exclusions in the 'Characteristics of excluded studies' tables.

Data extraction and management

For English and Mandarin full texts, two review authors independently extracted the study description and data for the primary and secondary outcomes on to paper data collection forms developed in collaboration with Cochrane Eyes and Vision. We resolved discrepancies by discussion to reach consensus. For full texts in Korean, one review author (YK) extracted the data. One review author entered data into Review Manager 5 (RevMan 2014), and a second review author verified the data entry.

Assessment of risk of bias in included studies

Two review authors independently assessed the risk of bias of included studies as part of the data extraction process. We followed the tools for assessing risk of bias set forth in Chapter 8 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011a). We examined the studies for the following 'Risk of bias' criteria: random sequence generation; allocation concealment; masking of participants, personnel, and outcome assessors; incomplete outcome data; selective outcome reporting; funding source; and other sources of bias. We labeled each quality criterion as high risk of bias, low risk of bias, or unclear risk of bias (lack of information or uncertainty over the potential for bias). We recorded the assessments in the 'Characteristics of included studies' tables.

Measures of treatment effect

Continuous data

For continuous outcomes, we analyzed the treatment effect as mean difference (MD) with 95% confidence intervals (CI). Continuous outcomes included SIA, BCVA, ECL, CCT, CDE use, amount of BSS, surgical time, and phacoemulsification time. None of the continuous outcomes used different scales, therefore we did not calculate standardized mean differences (SMDs); however, if appropriate, we would do so in future updates of this review.

Dichotomous data

We reported the treatment effect for dichotomous outcomes using risk ratio (RR).

Unit of analysis issues

The unit of analysis was the participant. None of the included trials had assigned individual eyes of a participant to different interventions (standard phacoemulsification, C-MICS, or B-MICS). Sample sizes in some included trials suggested paired-eye trials because the number of eyes included was twice the number of participants (Capella 2010; Hwang 2016; Musanovic 2012; Zhu 2014). We referred to Chapter 16 of the *Cochrane Handbook for Systematic Reviews of Interventions* as a guide for intraperson correlation between eyes (Higgins 2011b).

Dealing with missing data

We referred to guidelines in Chapter 16 of the *Cochrane Handbook for Systematic Reviews of Interventions* for information on handling missing data (Higgins 2011b). We attempted to contact study investigators to obtain missing data or to clarify reported information that was unclear. When the investigators did not respond within six weeks or after three attempts at contact, we extracted data as available from the published report.

Assessment of heterogeneity

We examined clinical, methodological, and statistical heterogeneity of the included studies. We used the I^2 statistic (%) to determine the proportion of variation in effect estimation, and concluded that an I^2 statistic above 50% suggested substantial statistical heterogeneity (Higgins 2003).

Assessment of reporting biases

All meta-analyses included fewer than 10 trials, therefore we did not use funnel plots to identify any publication biases. If more trials are added to future versions of the review, and the meta-analysis includes more than 10 trials, we intend to use funnel plots to identify potential publication bias.

Data synthesis

We summarized data from trials that had reported comparable outcome measures at similar follow-up times. In the absence of clinical, methodological, and substantial statistical heterogeneity, we performed meta-analysis. We used the fixed-effect model for meta-analysis of three or fewer trials. We used a random-effects model for meta-analysis of outcome data from more than three trials.

Sensitivity analysis

We intended to conduct sensitivity analyses to determine the impact of excluding studies with lower methodological quality, including exclusion of industry-funded studies and unpublished studies. However, data were insufficient to conduct such analyses.

Strength of evidence

We rated the strength of evidence using the GRADE approach (GRADEpro GDT 2015; Guyatt 2011), as recommended in the *Cochrane Handbook* (Schünemann 2011). We used the domains of risk of bias, directness of the evidence, inconsistency, imprecision, and publication bias.

'Summary of findings' table

We presented our results in a 'Summary of findings' table for four comparisons (Types of interventions). We presented the following six outcomes at three months' follow-up.

1. SIA data when measured
2. Postoperative BCVA on the LogMAR scale
3. Mean ECL measured with non-contact specular microscopy (cell/mm² or percentage decrease)
4. Mean CCT measured with ultrasonic pachymeter (μ m or percentage increase)
5. Adverse events
6. Quality of life as measured by any validated instruments

RESULTS

Description of studies

Results of the search

As of 28 October 2016, the electronic search yielded 6808 records ([Figure 1](#)). There were 2607 records after removal of duplicates. The

search of trial registries yielded 439 registered trials. There were 287 unique registered trials after removal of duplicates. We retrieved 72 full-text articles, of which we included 26 studies and excluded 46 studies with the reasons shown in the [Characteristics of excluded studies](#) table.

Figure 1. Study flow diagram.

Included studies

Twenty-six RCTs met the inclusion criteria of this review. Five of the 26 trials compared three interventions. Further details can be found in the [Characteristics of included studies](#) table.

Size of studies

There were 26 RCTs with a total of 2737 participants (3120 eyes). The number of participants in each trial ranged from 30, in [Mastropasqua 2011](#), to 362, in [Shan 2016](#).

Location of studies

One trial was conducted in Bosnia and Herzegovina ([Musanic 2012](#)), 13 trials in China ([Hui 2016](#); [Li 2016](#); [Lin 2013](#); [Luo 2012](#); [Mao 2008](#); [Shan 2016](#); [Shi 2013](#); [Wang 2009](#); [Yao 2008](#); [Yao 2011](#); [Yu 2016](#); [Zhang 2014](#); [Zhu 2014](#)), one trial in France ([Febbraro 2015](#)), one trial in India ([Vasavada 2013a](#)), one trial in Italy ([Mastropasqua 2011](#)), five trials in Korea ([Hwang 2008](#); [Hwang 2016](#); [Jeong 2013](#); [Li 2011](#); [Moon 2011](#)), two trials in Spain ([Capella 2010](#); [Morcillo-Laiz 2009](#)), one trial in Switzerland ([Dosso 2008](#)), and one trial in Turkey ([Can 2010](#)).

Comparisons

Five trials had three arms ([Can 2010](#); [Febbraro 2015](#); [Luo 2012](#); [Moon 2011](#); [Yu 2016](#)). [Can 2010](#) was included in all pair-wise comparisons, except the smaller C-MICS versus standard phacoemulsification comparison. [Febbraro 2015](#), [Luo 2012](#), and [Moon 2011](#) were included in all pair-wise comparisons except B-MICS compared with standard phacoemulsification. [Yu 2016](#) was only included in the comparison between the smaller C-MICS and standard phacoemulsification, as the third arm was microincisions with 2.0 mm incision, which is not of interest to this review. Follow-up time of these trials ranged from one to six months.

1. Fifteen trials compared the larger C-MICS with standard phacoemulsification ([Can 2010](#); [Febbraro 2015](#); [Hwang 2008](#); [Hwang 2016](#); [Jeong 2013](#); [Li 2011](#); [Li 2016](#); [Lin 2013](#); [Luo 2012](#); [Moon 2011](#); [Musanic 2012](#); [Shan 2016](#); [Shi 2013](#); [Wang 2009](#); [Zhu 2014](#)).
2. Nine trials compared the smaller C-MICS with standard phacoemulsification ([Capella 2010](#); [Dosso 2008](#); [Febbraro 2015](#); [Hui 2016](#); [Luo 2012](#); [Moon 2011](#); [Yao 2011](#); [Yu 2016](#); [Zhang 2014](#)).

3. Six trials compared the smaller C-MICS with the larger C-MICS ([Can 2010](#); [Febbraro 2015](#); [Luo 2012](#); [Mastropasqua 2011](#); [Moon 2011](#); [Vasavada 2013a](#)).
4. Four trials compared B-MICS with standard phacoemulsification ([Can 2010](#); [Mao 2008](#); [Morcillo-Laiz 2009](#); [Yao 2008](#)).

We did not make the following comparisons, as none of the included trials reported them.

1. B-MICS versus the larger C-MICS
2. B-MICS versus the smaller C-MICS

Type of IOL used

Five trials did not report the type of IOL inserted ([Can 2010](#); [Li 2011](#); [Musanic 2012](#); [Shan 2016](#); [Zhu 2014](#)).

The types of IOL used for the standard phacoemulsification were: AKREOS MI60 IOL (Bausch & Lomb), Lentis L-303 IOL (WaveLight GmbH), Adapt AO IOL (Bausch & Lomb, Rochester, NY, USA), SA60AT IOL (AcrySof; Alcon, USA), SN60WF IOL (Alcon), SENSER IOL (AMO), Y601075 (AJL, A 1ava, Spain), Staar KS-1 (Canon), PY-60 (Hoya, Japan), and ZEISS SPHERIS 209M.

The types of IOL used for the larger C-MICS were: AcrySof Natural SN60WF IOL (Alcon, Fort Worth, TX, USA), SA60AT IOL (AcrySof; Alcon, USA), MI60 IOL (Bausch & Lomb, Rochester, NY, USA), and AcrySof IQ IOL (Alcon, Fort Worth, TX, USA).

A limited number of IOLs could be used for the smaller C-MICS: AKREOS MI60 IOL (Bausch & Lomb), Lentis L-303 IOL (WaveLight GmbH), AcrySof SN60WF IOL (Alcon), and ZEISS ASPHINA 509M.

The types of IOL used for B-MICS, which was the smallest-sized incision, were: Acri.Smart46s (Acti.Tec), Acri.Smart 48S, and MI60 IOL (Bausch & Lomb).

Excluded studies

We excluded 46 full-text articles and documented our reasons for exclusion in the [Characteristics of excluded studies](#) tables.

Risk of bias in included studies

See 'Risk of bias' graph ([Figure 2](#)) and 'Risk of bias' summary table ([Figure 3](#)).

Figure 2. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

Figure 3. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Masking of participants and personnel (performance bias)	Masking of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Can 2010	?	?	?	?	?	?	+
Capella 2010	-	-	-	-	+	?	?
Dosso 2008	?	?	?	?	?	?	?
Febbraro 2015	?	?	?	?	?	?	?
Hui 2016	+	?	?	?	?	?	?
Hwang 2008	?	?	?	?	?	?	?
Hwang 2016	?	?	?	+	?	+	?
Jeong 2013	?	?	?	?	?	?	?
Li 2011	?	?	?	?	?	?	+
Li 2016	?	?	?	?	?	?	+
Lin 2013	-	?	?	?	-	?	?
Luo 2012	+	?	?	+	+	+	+
Mao 2008	?	?	?	?	?	?	?
Mastropasqua 2011	+	?	+	+	?	?	+
Moon 2011	?	?	?	?	?	?	?
Morcillo-Laiz 2009	?	?	+	+	+	?	?
Musanovic 2012	?	?	?	?	?	-	+
Shan 2016	?	?	?	?	?	?	?
Shi 2013	?	?	?	?	?	?	?
Vasavada 2013a	+	+	+	+	+	+	?

Figure 3. (Continued)

Vasavada 2013a	+	+	+	+	+	+	?
Wang 2009	?	?	+	+	?	?	?
Yao 2008	+	?	+	+	?	?	?
Yao 2011	+	?	+	+	+	?	?
Yu 2016	?	?	?	?	?	+	+
Zhang 2014	?	?	?	?	?	?	?
Zhu 2014	?	?	?	?	?	?	?

Allocation

We judged one trial to be at high risk, six trials at low risk, and 19 trials at unclear risk of selection bias based on the reporting of random sequence generation. When the study investigators reported the method of randomization, we judged the study to be at low risk of selection bias. We judged [Capella 2010](#) to be at high risk of bias because it was reported as a "prospective and randomised study" (p269), but the authors noted through email correspondence that the treatment assignment was by "alternating one-by-one."

We judged the following six trials to be at low risk of bias. [Luo 2012](#) used a random number generator, and participants were assigned by the remainder after dividing by 3. Participants in [Mastropasqua 2011](#) were randomly assigned to group 1 or group 2 the day before surgery by block randomization (randomly assigned by computer-generated numbers). After contacting the study investigator, [Vasavada 2013a](#) replied that "randomization was done using computer generated random numbers." [Hui 2016](#), [Yao 2008](#), and [Yao 2011](#) used "random numbers table" for sequence generation. Study investigators of the remaining trials mentioned that participants were randomized but did not specify the methods for random sequence generation, therefore we judged them to be at unclear risk of bias.

We judged [Capella 2010](#) to have inadequate allocation concealment; if the treatment was assigned by alternating one-by-one, participants might be able to guess their or the next treatment assignment. We judged [Vasavada 2013a](#) to have sufficient allocation concealment as the authors had informed us through email correspondence that the random number sequence was stored in a sequentially number and sealed envelope in a dedicated box in the operating room. The remaining trials did not provide sufficient information to determine whether treatment allocation was adequately concealed before randomization and were therefore judged to be at unclear risk of bias.

Masking (performance bias and detection bias)

We judged one trial to be high risk, six trials to be at low risk, and 19 trials at unclear risk of performance and detection bias. The authors of the trial judged to be at high risk of performance and detection bias reported through email that the participants, personnel, and outcome assessors were not masked. Trials that we judged to be at low risk of performance and detection bias explicitly reported masking of participants,

personnel, and outcome assessors. [Mastropasqua 2011](#) reported that participants and examiners performing preoperative and postoperative controls were masked to the surgical technique in each case. [Morcillo-Laiz 2009](#) was a double-blind clinical trial, and neither the participants nor the examiners knew which technique had been applied. [Vasavada 2013a](#) reported only that the trial was "double blind" (participants and outcome assessors) in the article; after contacting the study investigator, we received the following reply: "the patients and outcome assessors were blind to the technique used, however, the surgeon was not. The outcome assessor was another ophthalmologist, and not the operating surgeon." [Wang 2009](#) reported that participants and examiners were masked to the group assignment. In [Yao 2008](#) and [Yao 2011](#), participants were masked to their treatment groups; surgeons could not be masked, and standard surgical procedures were followed that were unlikely to result in bias. Study investigators of [Luo 2012](#) mentioned that only the technician and surgeon were masked during postoperative examinations, so we judged this trial to be at low risk of detection bias and unclear risk of performance bias. [Hwang 2016](#) did not report whether the participants were masked, but the image examiner was masked, so we judged this trial to be at low risk of detection bias and unclear risk of performance bias.

Incomplete outcome data

We judged one trial to be at high risk of bias, five at low risk of bias, and the remaining 20 trials at unclear risk of bias. The five trials judged to be at low risk of bias reported that either no participants or no more than 10% of participants were lost to follow-up. [Capella 2010](#) reported that 3% of 37 participants were lost to follow-up; [Morcillo-Laiz 2009](#) reported that 10% of 94 participants were lost to follow-up; and in [Yao 2011](#) 9% of 89 participants were lost to follow-up. We judged [Lin 2013](#) to be at high risk of bias as participants were excluded postrandomization. [Luo 2012](#) and [Vasavada 2013a](#) reported that no participants were lost to follow-up and were judged to be at low risk of attrition bias.

Selective reporting

We judged one trial to be at high risk of reporting bias. In the methods description of [Musanovic 2012](#), four outcomes were described; two of them, corneal keratometry and corneal astigmatism, were not reported in the results section.

We judged four trials to be at low risk of reporting bias. Four studies were registered ([Hwang 2016](#); [Luo 2012](#); [Vasavada 2013a](#); [Yu 2016](#)).

The outcomes that were described in the registry search were consistent with those reported in the papers.

We could not obtain the protocol or trial registration number for the remaining 21 trials and judged them to be at unclear risk of reporting bias. The authors of one trial noted through email correspondence that they did not publish the protocol or register the trial.

Other potential sources of bias

We judged seven trials to be at low risk of other potential sources of bias because they were not funded by device manufacturers or had declared no conflict of interest (Can 2010; Li 2011; Li 2016; Luo 2012; Mastropasqua 2011; Musanovic 2012; Yu 2016). The remaining 19 trials did not report their source of funding or conflict of interest, therefore we judged them to be at unclear risk of bias.

Effects of interventions

See: [Summary of findings for the main comparison](#) Larger coaxial microincision cataract surgery (C-MICS) versus standard phacoemulsification; [Summary of findings 2](#) Smaller coaxial microincision cataract surgery (C-MICS) versus standard phacoemulsification; [Summary of findings 3](#) Smaller coaxial microincision cataract surgery (C-MICS) versus larger C-MICS; [Summary of findings 4](#) Biaxial microincision cataract surgery (B-MICS) versus standard phacoemulsification

1. The larger C-MICS versus standard phacoemulsification

Fifteen trials reported outcomes for this comparison (Can 2010; Febraro 2015; Hwang 2008; Hwang 2016; Jeong 2013; Li 2011; Li 2016; Lin 2013; Luo 2012; Moon 2011; Musanovic 2012; Shan 2016; Shi 2013; Wang 2009; Zhu 2014). Shi 2013 included both eyes of 34 of 98 participants (35%) in the study, but they did not report to which group the eyes were allocated and did not account for intraperson correlation in their analysis. The larger C-MICS refers to the C-MICS with 2.2-millimeter incision.

Surgically induced astigmatism (SIA)

Surgically induced astigmatism was reported in nine out of the 15 trials at three months' follow-up (Febraro 2015; Hwang 2016; Lin 2013; Moon 2011; Musanovic 2012; Shan 2016; Shi 2013; Wang 2009; Zhu 2014). None of the trials reported on SIA at one year postoperatively. Moon 2011 reported the mean SIA in both groups, but did not report the standard deviation (SD) or standard error and also did not state clearly what the reported exact P value was testing. The mean SIA in the larger C-MICS group was 0.54 D, while it was 0.72 D in the standard phacoemulsification group.

The small difference suggested from eight trials may not have clinical importance ([Analysis 1.1](#); mean difference (MD) -0.19 D, 95% confidence interval (CI) -0.30 to -0.09; 996 eyes; $I^2 = 73\%$). We judged the evidence at three months to be very low-certainty due to unexplained statistical heterogeneity (downgraded one level) and high risk of bias, as one study was at high risk of selection and attrition bias, while another study was at high risk of reporting bias (downgraded two levels).

Best-corrected visual acuity (BCVA)

Seven of 15 trials reported BCVA at three months' follow-up (Can 2010; Hwang 2008; Hwang 2016; Lin 2013; Moon 2011; Shan 2016;

Wang 2009). Hwang 2008, Lin 2013, and Shan 2016 did not report the units of the BCVA measurement, which could be either decimal or logMAR units, therefore we did not include their data in the meta-analysis. We also could not include Wang 2009's BCVA data as it was reported as the percentages of participants that had greater or equal to 1.0 D, 0.8 D, or 0.5 D. The authors of Wang 2009 also noted that "postoperative uncorrected distance visual acuity tended to be better with the smaller incisions, but this trend did not reach statistical significance ($P = 0.07$)."

At three months after surgery, three trials showed little or no difference between the larger C-MICS group and the standard phacoemulsification group ([Analysis 1.2](#); MD 0.00 logMAR units, 95% CI -0.02 to 0.02; 242 eyes; $I^2 = 29\%$). We judged the certainty of the evidence to be low due to unclear risk of selection bias and attrition bias (downgraded two levels).

Endothelial cell loss (ECL)

Four of 15 trials reported mean ECL at three months' follow-up (Li 2011; Moon 2011; Shan 2016; Zhu 2014). No significant difference was found between the larger C-MICS and standard phacoemulsification ([Analysis 1.3](#); MD -7.23 cells/mm², 95% CI -78.66 to 64.20; 596 eyes; 4 trials; $I^2 = 0\%$). We judged the certainty of the evidence to be low due to risk of bias, as the studies were at unclear risk of selection, performance, detection, and attrition bias (downgraded two levels).

Central corneal thickness (CCT)

Six of 15 trials reported this outcome at any time point (Can 2010; Hwang 2016; Jeong 2013; Li 2011; Wang 2009; Zhu 2014). Hwang 2016 did not report the standard deviation, but reported the mean % increase in CCT: the mean % increase in CCT was 1.00% in the larger C-MICS group and 0.31% in the standard phacoemulsification group. Four of the five studies included in [Analysis 1.4](#) reported the mean CCT at three months (Can 2010; Li 2011; Wang 2009; Zhu 2014). In contrast, Jeong 2013 reported the mean change in CCT. Since the reported the baseline mean CCT was similar in Jeong 2013, we decided it was appropriate to include their results in [Analysis 1.4](#); at baseline the mean CCT was 530.02 (32.61) μm for the larger C-MICS group and 534.86 (31.23) μm for the standard phacoemulsification group, therefore we included their data in the meta-analysis.

Five trials showed little or no difference in CCT between the larger C-MICS and standard phacoemulsification groups at three months' postoperatively ([Analysis 1.4](#); MD -0.68 μm , 95% CI -3.26 to 1.90; 487 eyes; $I^2 = 0\%$). We judged the certainty of the evidence to be low due to risk of bias, as the studies were at unclear risk of selection, performance, detection, and attrition bias (downgraded two levels).

Intraoperative parameters

Six of 15 trials described intraoperative parameters (Can 2010; Jeong 2013; Li 2011; Luo 2012; Shan 2016; Wang 2009).

Studies comparing the larger C-MICS with standard phacoemulsification showed little or no difference in intraoperative use of cumulative dissipated energy (CDE) ([Analysis 1.5](#); MD -0.30%, 95% CI -1.33 to 0.72; 784 participants; 6 trials), intraoperative use of balanced salt solutions (BSS) ([Analysis 1.6](#); MD 2.87 mL, 95% CI -2.26 to 8.00; 80 eyes; 1 trial), surgical time ([Analysis 1.7](#); MD -0.05

minutes, 95% CI -0.26 to 0.16; 314 eyes; 3 trials; $I^2 = 46\%$), and phacoemulsification time (Analysis 1.8; MD -0.96 seconds, 95% CI -3.48 to 1.56; 608 eyes; 4 trials; $I^2 = 55\%$). The duration of surgical time and phacoemulsification time depends on the skills and preferences of different surgeons. We judged the certainty of the evidence to be low as we downgraded for unexplained statistical heterogeneity (downgraded two levels).

Adverse events

One of 15 trials reported that none of the participants experienced endophthalmitis or posterior capsule rupture (Shan 2016). The same trial reported little or no difference in the risk ratio (RR) of corneal edema (Analysis 1.9; RR 1.02, 95% CI 0.40 to 2.63; 362 eyes).

Wang 2009 reported "no intraoperative complications."

Quality of life

None of the 15 trials reported on quality of life.

2. The smaller C-MICS versus standard phacoemulsification

Nine trials compared these surgical approaches with respect to one or more outcomes of interest (Capella 2010; Dosso 2008; Febbraro 2015; Hui 2016; Luo 2012; Moon 2011; Yao 2011; Yu 2016; Zhang 2014). The smaller C-MICS refers to the C-MICS with 1.8-millimeter incision.

Surgically induced astigmatism (SIA)

Seven of nine trials reported this outcome at three months' follow-up (Capella 2010; Febbraro 2015; Hui 2016; Moon 2011; Yao 2011; Yu 2016; Zhang 2014). Two trials did not provide sufficient data to be included in a meta-analysis (Moon 2011; Yu 2016). Yu 2016 reported the group means and exact P value at three months' follow-up, and did not report the standard deviation by group, therefore the data could not be included in the meta-analysis. Moon 2011 reported the mean SIA in both groups, but did not report the group standard deviation. The mean SIA was 0.43 D in the smaller C-MICS group, and 0.72 D in the standard phacoemulsification group.

Meta-analysis of five trials favored the smaller C-MICS group over standard phacoemulsification (Analysis 2.1; MD -0.23 D, 95% CI -0.34 to -0.13; 561 eyes; $I^2 = 74\%$). The certainty of evidence was very low as we downgraded for unexplained statistical heterogeneity and high risk of selection, performance, and detection biases.

Best-corrected visual acuity (BCVA)

Three of nine trials reported this outcome at two to three months' follow-up (Dosso 2008; Moon 2011; Yao 2011). The smaller C-MICS group showed slightly better to no difference in BCVA results than standard phacoemulsification (Analysis 2.2; MD -0.02 logMAR unit, 95% CI -0.03 to -0.00; 192 eyes; $I^2 = 0\%$). The certainty of the evidence was low as we downgraded for high risk of bias as two studies were at unclear risk of selection, performance, detection, attrition, and reporting bias (downgraded two levels).

Endothelial cell loss (ECL)

Five of nine trials reported ECL after surgery (Capella 2010; Dosso 2008; Hui 2016; Moon 2011; Yao 2011). At three months' postoperatively, meta-analysis of five trials showed little or no difference between the smaller C-MICS and standard phacoemulsification groups (Analysis 2.3; MD 7.56 cells/mm², 95%

CI -67.65 to 82.77; 380 eyes; $I^2 = 12\%$). We judged the certainty of the evidence to be low as we downgraded for high risk of selection, performance, and detection bias (downgraded two levels).

Central corneal thickness (CCT)

Three of nine trials reported CCT change (Capella 2010; Dosso 2008; Yao 2011). The meta-analysis of the three trials showed little or no difference between the smaller C-MICS and standard phacoemulsification groups at three months' postoperatively (Analysis 2.4; MD -1.52 μ m, 95% CI -6.29 to 3.25; 245 eyes; $I^2 = 49\%$). We judged the certainty of the evidence to be low due to high risk of bias, including selection, performance, and detection bias (downgraded two levels).

Intraoperative parameters

Three of nine trials reported intraoperative parameters (Dosso 2008; Luo 2012; Yao 2011). The smaller C-MICS group was slightly favored over the standard phacoemulsification group in CDE (Analysis 2.5; MD -4.25%, 95% CI -5.43 to -3.07; 360 eyes; 2 trials; $I^2 = 78\%$). The evidence showed little or no difference between groups for the use of BSS (Analysis 2.6; MD -1.93 mL, 95% CI -6.32 to 2.46; 130 eyes; 2 trials; $I^2 = 85\%$), surgical time (Analysis 2.7; MD -0.14 minutes, 95% CI -0.35 to 0.07; 130 eyes; 2 trials; $I^2 = 93\%$), and phacoemulsification time (Analysis 2.8; MD 8.20 seconds, 95% CI 2.88 to 13.52; 130 eyes; 2 trials; $I^2 = 97\%$). Authors of Yao 2011 reported effective phacoemulsification time, which is a different measure than that reported by the authors of Dosso 2008 and Luo 2012. We were not able to identify a citation to convert effective phacoemulsification time to phacoemulsification time. The authors of Yao 2011 reported the mean effective phacoemulsification time was 6.71 seconds (SD = 4.14) in the smaller C-MICS group and 6.84 seconds (SD = 4.01) in the standard phacoemulsification group, showing little or no difference between the groups (MD -0.13 seconds, 95% CI -1.92 to 1.66; 40 eyes). We downgraded the certainty of the evidence to very low for unexplained statistical heterogeneity (downgraded two levels) and wide confidence intervals (downgraded one level).

Adverse events

None of the nine trials reported on adverse events.

Quality of life

None of the nine trials reported on quality of life.

3. The smaller C-MICS versus the larger C-MICS

Six trials compared these surgical techniques (Can 2010; Febbraro 2015; Luo 2012; Mastropasqua 2011; Moon 2011; Vasavada 2013a). Since C-MICS is used for two incision sizes and for clarity, we have referred to the smaller incision as C-MICS with 1.8-millimeter incision and the larger incision as C-MICS with 2.2-millimeter incision.

Surgically induced astigmatism (SIA)

Four of the six trials reported this outcome at three months' follow-up (Febbraro 2015; Mastropasqua 2011; Moon 2011; Vasavada 2013a). We did not include Moon 2011 in the meta-analysis as they reported the mean SIA in both groups, but did not report data to calculate SDs. The mean SIA was 0.43 D in the C-MICS (1.8 mm) group, and 0.54 D in the larger C-MICS group.

The meta-analysis showed little or no difference in SIA between the smaller and larger C-MICS groups in three trials ([Analysis 3.1](#); MD 0.04 D, 95% CI -0.09 to 0.16; 259 eyes; $I^2 = 78\%$). We judged the evidence to be of low-certainty as we downgraded for unexplained statistical heterogeneity (downgraded two levels).

Best-corrected visual acuity (BCVA)

Three of the six trials reported this outcome ([Mastropasqua 2011](#); [Moon 2011](#); [Vasavada 2013a](#)). The meta-analysis showed little or no difference in BCVA at three months' postoperatively ([Analysis 3.2](#); MD 0.01 logMAR, 95% CI -0.01 to 0.04; 200 eyes; $I^2 = 67\%$). [Moon 2011](#) reported a SD of 0.9 in both groups, which is abnormally high and therefore presumed to be a typo; we entered an SD of 0.09 instead. We judged the evidence to be of low-certainty, downgrading for unexplained statistical heterogeneity (downgraded two levels).

Endothelial cell loss (ECL)

[Moon 2011](#) was the only trial to report the mean ECL and showed less ECL in the larger C-MICS group than in the smaller C-MICS group ([Analysis 3.3](#); MD 213.00 cells/mm², 95% CI 11.15 to 414.85; 70 eyes). We judged the evidence to be of very low-certainty, downgrading for risk of bias as the study was judged to be at unclear risk of selection, performance, detection, attrition, and reporting bias (downgraded one level) and imprecision, as only one trial reported ECL at three months' follow-up (downgraded two levels).

Central corneal thickness (CCT)

One of the six trials reported CCT ([Vasavada 2013a](#)). The mean change of CCT comparing smaller C-MICS with larger C-MICS was 3.44 ± 7.43 μ m versus 2.99 ± 8.6 μ m at three months' postoperatively, respectively. The difference in change of CCT was trivial or nonexistent comparing the two groups at three months' postoperatively ([Analysis 3.4](#); MD 0.45 μ m, 95% CI -2.70 to 3.60; 100 eyes). We judged the evidence to be of low-certainty, downgrading for imprecision, as only one trial reported CCT at three months' follow-up (downgraded two levels).

Intraoperative parameters

Four of five trials reported intraoperative parameters ([Can 2010](#); [Luo 2012](#); [Mastropasqua 2011](#); [Vasavada 2013a](#)). Meta-analysis showed little or no difference in the use of CDE ([Analysis 3.5](#); MD -0.33%, 95% CI -3.72 to 3.07; 300 eyes; 4 trials; $I^2 = 82\%$) or the use of BSS ([Analysis 3.6](#); MD 1.04 mL, 95% CI -2.45 to 4.53; 210 eyes; 3 trials; $I^2 = 82\%$). Two trials reported the mean surgical time for each group ([Luo 2012](#); [Vasavada 2013a](#)). Meta-analysis showed surgical times to be slightly longer in the smaller C-MICS group compared with larger C-MICS group ([Analysis 3.7](#); MD 0.33 minutes, 95% CI 0.12 to 0.55; 180 eyes; $I^2 = 99\%$). The study investigators of [Luo 2012](#) were the only ones to report mean phacoemulsification times and showed there was little or no difference in phacoemulsification time between the two groups ([Analysis 3.8](#); MD -4.29 seconds, 95% CI -12.08 to 3.50; 80 eyes; $I^2 = 0\%$). We judged the evidence to be of low-certainty, downgrading for unexplained statistical heterogeneity (downgraded one level) and imprecision of results (downgraded one level).

Adverse events

None of the six trials reported on adverse events.

Quality of life

None of the six trials reported on quality of life.

4. B-MICS versus standard phacoemulsification

We found four trials that compared these procedures ([Can 2010](#); [Mao 2008](#); [Morcillo-Laiz 2009](#); [Yao 2008](#)).

Surgically induced astigmatism (SIA)

Two of four trials reported this outcome at different postoperative time points ([Morcillo-Laiz 2009](#); [Yao 2008](#)). Meta-analysis showed little or no difference between the B-MICS group and the standard phacoemulsification group at three months ([Analysis 4.1](#); MD -0.01 D, 95% CI -0.03 to 0.01; 368 eyes; $I^2 = 0\%$). We judged the evidence to be of moderate-certainty, downgrading only for risk of bias, as the trials were judged to be at unclear risk of selection and reporting bias (downgraded one level).

Only [Morcillo-Laiz 2009](#) reported SIA at six months' postoperatively; the mean SIA comparing the B-MICS group and the standard phacoemulsification group was 0.45 ± 0.35 D versus 0.41 ± 0.23 D, respectively. The trial results showed little or no difference between the B-MICS group and the standard phacoemulsification group ([Analysis 4.2](#); MD 0.04 D, 95% CI -0.08 to 0.16; 86 eyes).

Best-corrected visual acuity (BCVA)

Three of four trials reported this outcome at three months ([Can 2010](#); [Morcillo-Laiz 2009](#); [Yao 2008](#)). The meta-analysis of the three trials favored B-MICS over standard phacoemulsification, but the difference was trivial ([Analysis 4.3](#); MD -0.02 logMAR units, 95% CI -0.04 to -0.00; 464 eyes; $I^2 = 71\%$). We judged the evidence to be of low-certainty, downgrading for unexplained statistical heterogeneity (downgraded two levels).

Endothelial cell loss (ECL)

One of four trials reported this outcome three months' postoperatively ([Yao 2008](#)). Evidence from study investigators of [Yao 2008](#) reported that the mean ECL slightly favored B-MICS over standard phacoemulsification, but this was clinically trivial ([Analysis 4.4](#); MD 55.83 cells/mm², 95% CI -34.93 to 146.59; 280 eyes). We graded the evidence as of low-certainty, downgrading for imprecision and because only one trial reported ECL at three months' follow-up (downgraded two levels).

Central corneal thickness (CCT)

One of four trials reported this outcome ([Can 2010](#)). [Can 2010](#) found no clinically important difference between the two surgical approaches three months' postoperatively ([Analysis 4.5](#); MD 0.10 μ m, 95% CI -14.04 to 14.24; 90 eyes). We judged the evidence to be of low-certainty, downgrading for imprecision and because only one trial reported CCT at three months' follow-up (downgraded two levels).

Intraoperative parameters

Two of four trials reported these outcomes ([Can 2010](#); [Yao 2008](#)). Less CDE was used in the B-MICS group than in the standard phacoemulsification group ([Analysis 4.6](#); MD -5.27%, 95% CI -6.58 to -3.97; 370 eyes; 2 trials; $I^2 = 0\%$). The mean surgical time, reported by one study, was longer in the B-MICS group compared with the standard phacoemulsification group ([Analysis](#)

4.7; MD 4.31 minutes, 95% CI 2.03 to 6.59; 90 eyes); however, the phacoemulsification time in the B-MICS group was less than in the standard phacoemulsification group in two studies ([Analysis 4.8](#); MD -5.58 seconds, 95% CI -9.52 to -1.63; 370 eyes; $I^2 = 0\%$).

We judged the evidence to be of low-certainty, downgrading for imprecision of results and inconsistency (downgraded two levels).

Adverse events

None of the four trials reported on adverse events.

Quality of life

None of the four trials reported on quality of life.

DISCUSSION

Summary of main results

Comparison between larger C-MICS and standard phacoemulsification

Fifteen trials compared these interventions, but half of these trials or fewer reported data for each outcome of interest in this review ([Summary of findings for the main comparison](#)). The larger C-MICS group was favored over the standard phacoemulsification group for SIA and BCVA at three months' follow-up, but all differences were clinically small. The ECL, CCT change, and four intraoperative parameters showed little or no difference between the two groups. One trial reported on corneal edema, and another trial reported that there were no complications.

Comparison between smaller C-MICS and standard phacoemulsification

Nine trials compared these phacoemulsification approaches. The smaller C-MICS was favored over standard phacoemulsification for SIA and BCVA, but the differences were small ([Summary of findings 2](#)). There was little or no difference with respect to ECL and CCT change. Of the four intraoperative parameters, only CDE favored the smaller C-MICS. The included trials did not report on adverse events.

Comparison between smaller C-MICS and larger C-MICS

Six trials reported on this comparison. We found little or no difference in SIA, BCVA, and CCT change at three months' follow-up ([Summary of findings 3](#)). The surgical time in the larger C-MICS showed a slight advantage over the smaller C-MICS. However, other intraoperative parameters including CDE, phacoemulsification time, and the use of BSS showed little or no difference. None of the trials reported on adverse events.

Comparison between B-MICS and standard phacoemulsification

Four trials reported on this comparison. We found no difference or a clinically unimportant difference in SIA, BCVA, ECL, and CCT at three months' follow-up ([Summary of findings 4](#)). The surgical time was longer in the B-MICS group than in the standard phacoemulsification group, whereas phacoemulsification time and CDE in the B-MICS group was less than in the standard phacoemulsification group. None of the included trials reported on adverse events.

Overall completeness and applicability of evidence

We included 26 RCTs, of which half were conducted in China. Meta-analysis was possible for the primary review outcome comparing all four different-sized incisions: ≤ 1.5 mm, 1.8 mm, 2.2 mm, and approximately 3.0 mm. However, the meta-analysis results were inconsistent when comparing all four different-sized incisions, and the study methods were poorly reported. The low- to very low-certainty evidence did not consistently show that phacoemulsification with smaller incisions was associated with less surgically induced astigmatism compared with phacoemulsification with larger incisions. Poor reporting of the methods of all included studies resulted in a judgement of mostly unclear risk of bias.

Potential biases in the review process

We followed standard Cochrane methods and have no potential biases to report.

Agreements and disagreements with other studies or reviews

[Shentu 2016](#) conducted a meta-analysis of 15 RCTs, reported as of May 2015, to compare the larger C-MICS with 2.2-millimeter incision and standard phacoemulsification. In this review, the larger C-MICS had less SIA at one week and one month postoperatively; no between-group differences were detected in BSS use, CDE, BCVA, or CCT change. Their findings were consistent with our review except for that of BCVA. Seventeen studies included in this review were not included in [Shentu 2016](#) ([Capella 2010](#); [Febbraro 2015](#); [Hui 2016](#); [Hwang 2008](#); [Jeong 2013](#); [Li 2016](#); [Lin 2013](#); [Mao 2008](#); [Mastropasqua 2011](#); [Moon 2011](#); [Musanovic 2012](#); [Shan 2016](#); [Shi 2013](#); [Vasavada 2013a](#); [Yao 2008](#); [Yu 2016](#); [Zhang 2014](#)).

Our review findings that the astigmatic effects were the same for the smaller and larger C-MICS are consistent with the conclusions of [Febbraro 2015](#). Also, we agree with [Lee 2009](#) that there were no significant differences in SIA, postoperative BCVA, or amount of BSS used between these two groups.

A meta-analysis of 11 RCTs, [Yu 2012](#), evaluated the outcomes of B-MICS versus standard phacoemulsification and showed CDE and phacoemulsification time to be significantly less in the B-MICS group, which is consistent with our review. However, their review showed less SIA in the B-MICS group, which is not consistent with our review. The difference in conclusions might be the result of the inclusion of different trials. We excluded eight RCTs that were included in [Yu 2012](#); our reasons for exclusion are listed in the [Characteristics of excluded studies](#) table ([Alio 2005](#); [Crema 2007](#); [Denoyer 2008](#); [Kahraman 2007](#); [Kurz 2006](#); [Kurz 2009](#); [Mencucci 2006](#)). Also, [Mao 2008](#), which was included in this review, was not included in [Yu 2012](#).

AUTHORS' CONCLUSIONS

Implications for practice

This review was limited by the very low- to moderate-certainty evidence that did not show a consistent benefit in smaller incisions with respect to surgically induced astigmatism. Furthermore, the lack of adequately reported adverse events does not inform patients or ophthalmologists of the potential harm of any of the procedures relative to others. Ultimately, the choice of surgical

technique should be based on the patient's medical history, patient and physician preferences, and the skill of the surgeon.

Implications for research

There is a need for better-reported randomized controlled trials and randomized controlled trials that collect and report data on adverse events when comparing different-sized incisions for age-related cataract. Participants would be followed longer (at least three months) after surgery to investigate the rate of recovery for endothelial cells and the rehabilitation of visual acuity. Furthermore, better reporting of the randomization method, how the allocation was concealed before randomization, masking (participants, personnel, and outcome assessors), complete outcome data, methods, trial registry number, and source of

funding is necessary. Availability of trial protocols and registrations should also be reported. In addition, study investigators must explicitly report all adverse events during and after surgery so as to assess the safety of using different-sized incisions for phacoemulsification.

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REFERENCES

References to studies included in this review

Can 2010 {published data only}

Can I, Takmaz T, Yildiz Y, Bayhan HA, Soyugelen G, Bostanci B. Coaxial, microcoaxial, and biaxial microincision cataract surgery: prospective comparative study. *Journal of Cataract and Refractive Surgery* 2010;**36**(5):740-6.

Capella 2010 {published data only}

Capella MJ, Barraquer E. Comparative study of coaxial microincision cataract surgery and standard phacoemulsification [Estudio comparativo entre cirugía de catarata por microincisión coaxial y facoemulsificación estándar]. *Archivos de la Sociedad Española de Oftalmología* 2010;**85**(8):268-73.

Dosso 2008 {published data only}

Dosso AA, Cottet L, Burgener ND, Di Nardo S. Outcomes of coaxial microincision cataract surgery versus conventional coaxial cataract surgery. *Journal of Cataract and Refractive Surgery* 2008;**34**(2):284-8.

Febbraro 2015 {published data only}

Febbraro JI, Wang L, Borasio E, Richiardi L, Khan HN, Saad A, et al. Astigmatic equivalence of 2.2-mm and 1.8-mm superior clear corneal cataract incision. *Graefe's Archive for Clinical and Experimental Ophthalmology* 2015; Vol. 253, issue 2:261-5.

Hui 2016 {published data only}

Hui N, Yu L, Wang CY, Yang XG. Clinical effects of coaxial 1.8 mm microincision phacoemulsification. *International Eye Science* 2016;**16**(10):1828-31.

Hwang 2008 {published data only}

Hwang SJ, Choi SK, Oh SH, Lee JH, Kim JH, Lee DH. Surgically induced astigmatism and corneal higher order aberrations in microcoaxial and conventional cataract surgery. *Journal of the Korean Ophthalmological Society* 2008; Vol. 49, issue 10:1597-602.

Hwang 2016 {published data only}

Hwang HS, Ahn YJ, Lee HJ, Kim MS, Kim EC. Comparison of macular thickness and inflammatory cytokine levels after microincision versus small incision coaxial cataract surgery. *Acta Ophthalmologica* 2016; Vol. 94, issue 3:189-94.

Jeong 2013 {published data only}

Jeong JH, Lee HJ, Lee SH. Comparison of phacodynamic effects on postoperative corneal edema between 2.8 mm and 2.2 mm microcoaxial torsional phacoemulsification. *Journal of the Korean Ophthalmological Society* 2013; Vol. 54, issue 5:709-15.

Li 2011 {published data only}

Li YJ, Kim HJ, Joo CK. Early changes in corneal edema following torsional phacoemulsification using anterior segment optical coherence tomography and Scheimpflug photography. *Japanese Journal of Ophthalmology* 2011;**55**(3):196-204.

Li 2016 {published data only}

Li K, Lin ZX, Li L. Changes of the ocular surface and tear film after clear corneal incision phacoemulsification with different incision sizes. *International Eye Science* 2016; Vol. 16, issue 1:80-3.

Lin 2013 {published data only}

Lin YJ, Liang XJ, He JX, Zhao SY, Yang XY, Zeng S. Observation of corneal astigmatism induced by 2.2 mm micro-incision coaxial phacoemulsification. *International Eye Science* 2013;**13**(7):1464-6.

Luo 2012 {published data only}

Luo L, Lin H, He M, Congdon N, Yang Y, Liu Y. Clinical evaluation of three incision size-dependent phacoemulsification systems. *American Journal of Ophthalmology* 2012;**153**(5):831-9.

Mao 2008 {published data only}

Mao ZH, Zhang GB, Chen W, Liu L, He XH. Analysis of the visual quality after bimanual phacoemulsification via micro-incision [双手微小切口白内障超声乳化术术后视觉质量分析]. *International Journal of Ophthalmology* 2008;**8**(7):1373-4.

Mastropasqua 2011 {published data only}

Mastropasqua L, Toto L, Vecchiario L, Di Nicola M, Mastropasqua R. Microcoaxial torsional cataract surgery 1.8 mm versus 2.2 mm: functional and morphological assessment. *Ophthalmic Surgery, Lasers and Imaging* 2011;**42**(2):114-24.

Moon 2011 {published data only}

Moon SJ, Lee DJ, Lee KH. Induced astigmatism and high-order aberrations after 1.8-mm, 2.2-mm and 3.0-mm coaxial phacoemulsification incisions. *Journal of the Korean Ophthalmological Society* 2011; Vol. 52, issue 4:407-13.

Morcillo-Laiz 2009 {published data only}

Morcillo-Laiz R, Zato MA, Munoz-Negrete FJ, Arnalich-Montiel F. Surgically induced astigmatism after biaxial phacoemulsification compared to coaxial phacoemulsification. *Eye* 2009;**23**(4):835-9.

Musanovic 2012 {published data only}

Musanovic Z, Jusufovic V, Halibasic M, Zvornicanin J. Corneal astigmatism after micro-incision cataract operation. *Medicinski Arhiv* 2012;**66**(2):125-8.

Shan 2016 {published data only}

Shan WQ, Lei XP, Tang Y, Gao LN, Ren YG, Zhao X, et al. Evaluation on curative effect of coaxial 2.2 mm and 2.8 mm incision phacoemulsification for cataract. *International Eye Science* 2016;**16**(1):97-9.

Shi 2013 {published data only}

Shi Q, Zhou Y, Chu L, Feng Y. Clinical evaluation on the coaxial microincision cataract surgery in hard nuclear cataracts [微小切口超声乳化手术在硬核白内障病例中的效果评价]. *International Eye Science* 2013;**13**(5):934-6.

Vasavada 2013a {published data only}

Vasavada V, Vasavada AR, Vasavada VA, Srivastava S, Gajjar DU, Mehta S. Incision integrity and postoperative outcomes after microcoaxial phacoemulsification performed using 2 incision-dependent systems. *Journal of Cataract and Refractive Surgery* 2013;**39**(4):563-71.

Wang 2009 {published data only}

Wang J, Zhang EK, Fan WY, Ma JX, Zhao PF. The effect of micro-incision and small-incision coaxial phaco-emulsification on corneal astigmatism. *Clinical and Experimental Ophthalmology* 2009;**37**(7):664-9.

Yao 2008 {published data only}

Yao K, Tang XJ, Huang XD, Ye PP. Clinical evaluation on the bimanual microincision cataract surgery [双手法微切口超声乳化白内障吸除联合人工晶状体植入术的临床效果评价]. *Chinese Journal of Ophthalmology* 2008;**44**(6):525-8.

Yao 2011 {published data only}

Yao K, Wang W, Wu W, Tang XJ, Li ZC, Jin CF. Clinical evaluation on the coaxial 1.8 mm microincision cataract surgery [同轴1.8mm微切口超声乳化白内障手术临床效果评价]. *Chinese Journal of Ophthalmology* 2011;**47**(10):903-7.

Yu 2016 {published data only}

Yu YB, Zhu YN, Wang W, Zhang YD, Yu YH, Yao K. A comparable study of clinical and optical outcomes after 1.8, 2.0 mm microcoaxial and 3.0 mm coaxial cataract surgery. *International Journal of Ophthalmology* 2016;**9**(3):399-405.

Zhang 2014 {published data only}

Zhang JZ, Chen JH, Huang BJ, Jiang Y, Zhuang YZ, Li XX, et al. Effect of 1.8 mm coaxial micro-incision cataract phacoemulsification on corneal astigmatism. *International Eye Science* 2014;**14**(4):670-2.

Zhu 2014 {published data only}

Zhu JG, Cao Y, Xu QH. Comparison of 2.2 mm micro incision and 3.0 mm incision coaxial phacoemulsification. *International Eye Science* 2014; Vol. 14, issue 8:1433-5.

References to studies excluded from this review
Alio 2005 {published data only}

Alio J, Rodriguez-Prats JL, Galal A, Ramzy M. Outcomes of microincision cataract surgery versus coaxial phacoemulsification. *Ophthalmology* 2005;**112**(11):1997-2003.

Alio 2010 {published data only}

Alio JL, Elkady B, Ortiz D. Corneal optical quality following sub 1.8 mm micro-incision cataract surgery vs. 2.2 mm mini-incision coaxial phacoemulsification. *Middle East African Journal of Ophthalmology* 2010;**17**(1):94-9.

Bhargava 2016 {published data only}

Bhargava R, Kumar P, Sharma SK, Arora Y. Phacoemulsification versus manual small incision cataract surgery in patients with Fuchs heterochromic iridocyclitis. *Asia-Pacific Journal of Ophthalmology* 2016;**5**(5):330-4.

Can 2011 {published data only}

Can I, Bayhan HA, Celik H, Ceran BB. Anterior segment optical coherence tomography evaluation and comparison of main clear corneal incisions in microcoaxial and biaxial cataract surgery. *Journal of Cataract and Refractive Surgery* 2011;**37**(3):490-500.

Can 2012 {published data only}

Can I, Bayhan HA, Celik H, Ceran BB. Comparison of corneal aberrations after biaxial microincision and microcoaxial cataract surgeries: a prospective study. *Current Eye Research* 2012;**37**(1):18-24.

Cavallini 2007 {published data only}

Cavallini GM, Campi L, Masini C, Pelloni S, Pupino A. Bimanual microphacoemulsification versus coaxial miniphacoemulsification: prospective study. *Journal of Cataract and Refractive Surgery* 2007;**33**(3):387-92.

Chee 2010 {published data only}

Chee SP, Ti SE, Lim L, Chan AS, Jap A. Anterior segment optical coherence tomography evaluation of the integrity of clear corneal incisions: a comparison between 2.2-mm and 2.65-mm main incisions. *American Journal of Ophthalmology* 2010;**149**(5):768-76.

Crema 2007 {published data only}

Crema AS, Walsh A, Yamane Y, Nose W. Comparative study of coaxial phacoemulsification and microincision cataract surgery. One-year follow-up. *Journal of Cataract and Refractive Surgery* 2007;**33**(6):1014-8.

Denoyer 2008 {published data only}

Denoyer A, Denoyer L, Marotte D, Georget M, Pisella PJ. Intraindividual comparative study of corneal and ocular wavefront aberrations after biaxial microincision versus coaxial small-incision cataract surgery. *British Journal of Ophthalmology* 2008;**92**(12):1679-84.

Devendra 2014 {published data only}

Devendra J, Agarwal S, Singh P. A comparative study of clear corneal phacoemulsification with rigid IOL versus SICS; the preferred surgical technique in low socio-economic group patients of rural areas. *Journal of Clinical and Diagnostic Research* 2014; Vol. 8, issue 11:Vc01-03.

Dick 2012 {published data only}

Dick HB. Controlled clinical trial comparing biaxial microincision with coaxial small incision for cataract surgery. *European Journal of Ophthalmology* 2012;**22**(5):739-50.

Elkady 2009 {published data only}

Elkady B, Pinero D, Alio JL. Corneal incision quality: microincision cataract surgery versus microcoaxial phacoemulsification. *Journal of Cataract and Refractive Surgery* 2009;**35**(3):466-74.

Feng 2015 {published data only}

Feng XC, Pan WM, Guo L, Xie JR, Li HY. Research on refractive status characteristics and anterior chamber depth after cataract surgery. *International Eye Science* 2015; Vol. 15, issue 7:1194-6.

Franchini 2006 {published data only}

Franchini A, Frosini S, Boddi V. Standard coaxial phaco vs microincision cataract surgery: a corneal endothelium study. *International Journal of Ophthalmology* 2006;**6**(4):769-74.

Gangwani 2011 {published data only}

Gangwani V, Hirnschall N, Koshy J, Crnej A, Nishi Y, Maurino V, et al. Posterior capsule opacification and capsular bag performance of a microincision intraocular lens. *Journal of Cataract and Refractive Surgery* 2011; Vol. 37, issue 11:1988-92.

Hashemian 2007 {published data only}

Hashemian SJ. Microcoaxial phacoemulsification vs. conventional phacoemulsification. *American Academy of Ophthalmology*; 2007 Nov 10-13; New Orleans (LA) 2007:204.

Hayashi 2014 {published data only}

Hayashi K, Yoshida M, Yoshimura K. Immediate changes in intraocular pressure after clear corneal micro-incision versus small-incision cataract surgery. *Japanese Journal of Ophthalmology* 2014; Vol. 58, issue 5:402-8.

Hayashi 2016 {published data only}

Hayashi K, Ogawa S, Yoshida M, Yoshimura K. Wound stability and surgically induced corneal astigmatism after transconjunctival single-plane sclerocorneal incision cataract surgery. *Japanese Journal of Ophthalmology* 2016;**61**(1):113-23.

Jain 2015 {published data only}

Jain VK, Khokhar S, Agarwal A, Vanathi M, Kaushik J, Ram J. Microincision versus standard corneal incision phacoemulsification: visual outcome. *Optometry and Vision Science* 2015; Vol. 92, issue 7:796-803.

Jeon 2010 {published data only}

Jeon S, Na KS, Kim MS. The effect of manipulation of corneal incision on astigmatism during the cataract surgery. *Journal of the Korean Ophthalmological Society* 2010; Vol. 51, issue 4:510-5.

Jiang 2005 {published data only}

Jiang Y, Luo L, Liu Y, Wu M, Zhang X, Liu Y. Ultrasonic power application in bimanual microphacoemulsification [双手微切口白内障超声乳化术的超声能量应用研究]. *Chinese Ophthalmic Research* 2005;**23**(5):528-31.

Kahraman 2007 {published data only}

Kahraman G, Amon M, Franz C, Prinz A, Abela-Formanek C. Intraindividual comparison of surgical trauma after bimanual microincision and conventional small-incision coaxial phacoemulsification. *Journal of Cataract and Refractive Surgery* 2007;**33**(4):618-22.

Kaya 2007 {published data only}

Kaya V, Ozturker ZK, Ozturker C, Yasar O, Sivrikaya H, Agca A, et al. ThinOptX vs AcrySof: comparison of visual and refractive results, contrast sensitivity, and the incidence of posterior capsule opacification. *European Journal of Ophthalmology* 2007;**17**(3):307-14.

Kim 2011 {published data only}

Kim EC, Byun YS, Kim MS. Microincision versus small-incision coaxial cataract surgery using different power modes for hard nuclear cataract. *Journal of Cataract and Refractive Surgery* 2011;**37**(10):1799-805.

Kim 2013 {published data only}

Kim JH, Kim TI, Kim EK, Lee HK. The morphological changes in main corneal incision (2.2 mm vs. 2.8 mm) evaluated using anterior segment optical coherence tomography. *Journal of the Korean Ophthalmological Society* 2013; Vol. 54, issue 6:877-86.

Kochhar 2014 {published data only}

Kochhar S, Bansal A, Ahuja A, Gupta VS. Comparative study of optical coherence tomography documented macular changes following uncomplicated cataract surgery. *Clinical and Experimental Ophthalmology* 2014; Vol. 42:78.

Kurz 2006 {published data only}

Kurz S, Krummenauer F, Gabriel P, Pfeiffer N, Dick HB. Biaxial microincision versus coaxial small-incision clear cornea cataract surgery. *Ophthalmology* 2006;**113**(10):1818-26.

Kurz 2009 {published data only}

Kurz S, Krummenauer F, Thieme H, Dick HB. Optical coherence tomography of macular thickness after biaxial vs coaxial microincision clear corneal cataract surgery. *European Journal of Ophthalmology* 2009;**19**(6):990-7.

Lee 2009 {published data only}

Lee KM, Kwon HG, Joo CK. Microcoaxial cataract surgery outcomes: comparison of 1.8 mm system and 2.2 mm system. *Journal of Cataract and Refractive Surgery* 2009;**35**(5):874-80.

Masket 2009 {published data only}

Masket S, Wang L, Belani S. Induced astigmatism with 2.2- and 3.0-mm coaxial phacoemulsification incisions. *Journal of Refractive Surgery* 2009;**25**(1):21-4.

Mencucci 2006 {published data only}

Mencucci R, Ponchietti C, Virgili G, Giansanti F, Menchini U. Corneal endothelial damage after cataract surgery: microincision versus standard technique. *Journal of Cataract and Refractive Surgery* 2006;**32**(8):1351-4.

NCT02642211 {published data only}

NCT02642211. IOP changes associated with SICS and phako. clinicaltrials.gov/ct2/show/NCT02642211 (first received 19 December 2015).

Park 2012 {published data only}

Park YG, Chung SH, Joo CK. Comparison of microcoaxial with standard clear corneal incisions in torsional handpiece cataract surgery. *Ophthalmologica* 2012;**227**(1):55-9.

Shen 2014 {published data only}

Shen MH, Fang CK. Long-term effect of different incisions on the tear film after phacoemulsification. *International Eye Science* 2014;**14**(2):300-3.

Song 2014 {published data only}

Song ZY, Chen FH, Cheng F, Yan AM, Qiu X, Lou XF. Effect of micro-incision on corneal wavefront aberration and tear film in phacoemulsification. *International Eye Science* 2014; Vol. 14, issue 12:2207-9.

Suasnavas 2010 {published data only}

Suasnavas AC, Estrella MJ. Cataract surgery induced astigmatism with phacoemulsification and 2.2 mm versus 2.75 mm incision: a prospective study [Cirugía de catarata con facoemulsificación y astigmatismo inducido con incisión 2.2 vs. 2.75 mm: estudio prospectivo]. *Metro Ciencia* 2010;**19**(1):5-9.

Titiyal 2006 {published data only}

Titiyal JS, More PD, Vajpayee RB, Tandon R, Sharma N. Comparative evaluation of bimanual microincision cataract surgery with coaxial phacoemulsification surgery. *American Academy of Ophthalmology*; 2006 Nov 11-14 Las Vegas (NV). 2006; Vol. 35:204.

Tong 2008 {published data only}

Tong N, He JC, Lu F, Wang Q, Qu J, Zhao YE. Changes in corneal wavefront aberrations in microincision and small-incision cataract surgery. *Journal of Cataract and Refractive Surgery* 2008;**34**(12):2085-90.

Vasavada 2013b {published data only}

Vasavada AR, Johar K Sr, Praveen MR, Vasavada VA, Arora AI. Histomorphological and immunofluorescence evaluation of clear corneal incisions after microcoaxial phacoemulsification with 2.2 mm and 1.8 mm systems. *Journal of Cataract and Refractive Surgery* 2013;**39**(4):617-23.

von Sonnleithner 2015 {published data only}

von Sonnleithner C, Bergholz R, Gonnermann J, Klamann MK, Torun N, Bertelmann E. Clinical results and higher-order aberrations after 1.4-mm biaxial cataract surgery and implantation of a new aspheric intraocular lens. *Ophthalmic Research* 2015;**53**(1):8-14.

Wang 2012 {published data only}

Wang Y, Xia Y, Liu X, Zheng D, Luo L, Liu Y. Comparison of bimanual and micro-coaxial phacoemulsification with torsional ultrasound. *Acta Ophthalmologica* 2012;**90**(2):184-7.

Wei 2012 {published data only}

Wei YH, Chen WL, Su PY, Shen EP, Hu FR. The influence of corneal wound size on surgically induced corneal astigmatism after phacoemulsification. *Journal of the Formosan Medical Association* 2012;**111**(5):284-9.

Wilczynska 2010 {published data only}

Wilczynska O, Wilczynski M, Omulecki W. Surgically induced astigmatism after bimanual phacoemulsification through microincision and after standard phacoemulsification [Niezborność indukowana chirurgicznie po bimanualnej fakoemulsyfikacji przez mikrociecie oraz po standardowej fakoemulsyfikacji zacmy]. *Klinika Oczna* 2010;**112**(4-6):115-9.

Wylegala 2009 {published data only}

Wylegala E, Rebekowska-Juraszek M, Dobrowolski D, Woyna-Orlewicz A. Influence of 3.0 mm incision coaxial phacoemulsification and microincision cataract surgery (MICS) on corneal thickness [Wplyw fakoemulsyfikacji zacmy technika koaksjalna z ciecia 3.0 mm i metoda malego ciecia (MICS) na grubosc rogowki]. *Klinika Oczna* 2009;**111**(7-9):207-11.

Yao 2006 {published data only}

Yao K, Tang X, Ye P. Corneal astigmatism, high order aberrations, and optical quality after cataract surgery: microincision versus small incision. *Journal of Refractive Surgery* 2006;**22**(9 Suppl):S1079-82.

Zhou 2012 {published data only}

Zhou Y, Chang P, Wang D, Zhao Y. Influence of different length corneal limbal incisions on the anterior and posterior corneal astigmatism after phacoemulsification [两种不同长度角膜缘切口对白内障超声乳化术后角膜前后表面散光影响的对比]. *Chinese Journal of Experimental Ophthalmology* 2012;**30**(6):543-7.

Additional references
Ang 2014

Ang M, Evans JR, Mehta JS. Manual small incision cataract surgery (MSICS) with posterior chamber intraocular lens versus extracapsular cataract extraction (ECCE) with posterior chamber intraocular lens for age-related cataract. *Cochrane Database of Systematic Reviews* 2014, Issue 11. [DOI: [10.1002/14651858.CD008811.pub3](https://doi.org/10.1002/14651858.CD008811.pub3)]

Aravind 2008

Aravind S, Haripriya A, Sumara Taranum BS. Cataract surgery and intraocular lens manufacturing in India. *Current Opinion in Ophthalmology* 2008;**19**(1):60-5.

Asbell 2005

Asbell PA, Dualan I, Mindel J, Brocks D, Ahmad M, Epstein S. Age-related cataract. *Lancet* 2005;**365**(9459):599-609.

Behndig 2011

Behndig A, Montan P, Stenevi U, Kugelberg M, Lundström M. One million cataract surgeries: Swedish National Cataract Register 1992-2009. *Journal of Cataract and Refractive Surgery* 2011;**37**(8):1539-45.

Chee 2005

Chee SP, Bacsal K. Endophthalmitis after microincision cataract surgery. *Journal of Cataract and Refractive Surgery* 2005;**31**(9):1834-5.

de Silva 2014

de Silva SR, Riaz Y, Evans JR. Phacoemulsification with posterior chamber intraocular lens versus extracapsular cataract extraction (ECCE) with posterior chamber intraocular lens for age-related cataract. *Cochrane Database of Systematic Reviews* 2014, Issue 1. [DOI: [10.1002/14651858.CD008812.pub2](https://doi.org/10.1002/14651858.CD008812.pub2)]

Foster 2005

Foster A, Resnikoff S. The impact of Vision 2020 on global blindness. *Eye* 2005;**19**(10):1133-5.

Frick 2003

Frick KD, Foster A. The magnitude and cost of global blindness: an increasing problem that can be alleviated. *American Journal of Ophthalmology* 2003;**135**(4):471-6.

Glanville 2006

Glanville JM, Lefebvre C, Miles JN, Camosso-Stepinovic J. How to identify randomized controlled trials in MEDLINE: ten years on. *Journal of the Medical Library Association* 2006;**94**(2):130-6.

GRADEpro GDT 2015 [Computer program]

McMaster University (developed by Evidence Prime, Inc.). Available from www.gradepro.org. GRADEpro Guideline Development Tool. McMaster University (developed by Evidence Prime, Inc.). Available from www.gradepro.org, 2015.

Guyatt 2011

Guyatt GH, Oxman AD, Schunemann HJ, Tugwell P, Knottnerus A. GRADE guidelines: a new series of articles in the Journal of Clinical Epidemiology. *Journal of Clinical Epidemiology* 2011;**64**:380-2.

Higgins 2003

Higgins JPT, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ* 2003;**327**:557-60.

Higgins 2011a

Higgins JP, Altman DG, Sterne JAC, editor(s). Chapter 8: Assessing risk of bias in included studies. In: Higgins JP, Green S, editor(s). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 (updated March 2011). The Cochrane Collaboration, 2011. Available from handbook.cochrane.org.

Higgins 2011b

Higgins JP, Deeks JJ, Altman DG, editor(s). Chapter 16: Special topics in statistics. In: Higgins JP, Green S, editor(s). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 (updated March 2011). The Cochrane Collaboration, 2011. Available from handbook.cochrane.org.

Kelman 1967

Kelman CD. Phaco-emulsification and aspiration. A new technique of cataract removal. A preliminary report. *American Journal of Ophthalmology* 1967;**64**(1):23-35.

Lam 2009

Lam DS, Rao SK, Wong VW, Yao K, Abhay R, Vasavada DF, et al. *Ophthalmic Surgery Cataract II Advanced Phaco Surgery*. Hong Kong: Bon Vision Limited, 2009.

Mathew 2012

Mathew MC, Ervin AM, Tao J, Davis RM. Antioxidant vitamin supplementation for preventing and slowing the progression of age-related cataract. *Cochrane Database of Systematic Reviews* 2012, Issue 6. [DOI: [10.1002/14651858.CD004567.pub2](https://doi.org/10.1002/14651858.CD004567.pub2)]

Osher 2007a

Osher RH, Injev VP. Microcoaxial phacoemulsification Part 1: laboratory studies. *Journal of Cataract and Refractive Surgery* 2007;**33**(3):401-7.

Osher 2007b

Osher RH. Microcoaxial phacoemulsification Part 2: clinical study. *Journal of Cataract and Refractive Surgery* 2007;**33**(3):408-12.

Paul 2005

Paul T, Braga-Mele R. Bimanual microincisional phacoemulsification: the future of cataract surgery?. *Current Opinion in Ophthalmology* 2005;**16**(1):2-7.

Resnikoff 2004

Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, Pokharel GP, et al. Global data on visual impairment in the year 2002. *Bulletin of the World Health Organization* 2004;**82**(11):844-51.

RevMan 2014 [Computer program]

Nordic Cochrane Centre, The Cochrane Collaboration. Review Manager 5 (RevMan 5). Version 5.3. Copenhagen: Nordic Cochrane Centre, The Cochrane Collaboration, 2014.

Riaz 2006

Riaz Y, Mehta JS, Wormald R, Evans JR, Foster A, Ravilla T, et al. Surgical interventions for age-related cataract. *Cochrane Database of Systematic Reviews* 2006, Issue 4. [DOI: [10.1002/14651858.CD001323.pub2](https://doi.org/10.1002/14651858.CD001323.pub2)]

Riaz 2013

Riaz Y, de Silva SR, Evans JR. Manual small incision cataract surgery (MSICS) with posterior chamber intraocular lens versus phacoemulsification with posterior chamber intraocular lens for age-related cataract. *Cochrane Database of Systematic Reviews* 2013, Issue 10. [DOI: [10.1002/14651858.CD008813.pub2](https://doi.org/10.1002/14651858.CD008813.pub2)]

Schlote 2006

Schlote T, Rohrbach J, Grueb M, Mielke J. *Pocket Atlas of Ophthalmology*. New York: Thieme, 2006.

Schünemann 2011

Schünemann HJ, Oxman AD, Vist GE, Higgins JPT, Deeks JJ, Glasziou P, et al. Chapter 12: Interpreting results and drawing conclusions. In: Higgins JPT, Green S, editor(s). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 (updated March 2011). The Cochrane Collaboration, 2011. Available from handbook.cochrane.org.

Shentu 2016

Shentu X, Zhang X, Tang X, Yu X. Coaxial microincision cataract surgery versus standard coaxial small-incision cataract surgery: a meta-analysis of randomized controlled trials. *PLOS ONE* 2016;**11**(1):e0146676.

Shiels 2010

Shiels A, Bennett TM, Hejtmancik JF. Cat-Map: putting cataract on the map. *Molecular Vision* 2010;**16**:2007-15.

Weikert 2006

Weikert MP. Update on bimanual microincisional cataract surgery. *Current Opinion in Ophthalmology* 2006;**17**(1):62-7.

Available at www.who.int/mediacentre/factsheets/fs214/en (accessed 14 September 2017).

WHO 2017

World Health Organization. Blindness: Vision 2020 - control of major blinding diseases and disorders. The Global Initiative for the Elimination of Avoidable Blindness. Fact sheet N°214.

Yu 2012

Yu JG, Zhao YE, Shi JL, Ye T, Jin N, Wang QM, et al. Biaxial microincision cataract surgery versus conventional coaxial cataract surgery: meta-analysis of randomized controlled trials. *Journal of Cataract and Refractive Surgery* 2012;**38**(5):894-901.

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Can 2010

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 135 eyes of 96 participants in total; 45 eyes of 32 participants in each of the 3 groups</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: not reported, assumed to be: 135 eyes of 96 participants in total; 45 eyes of 32 participants in each of the 3 groups</p> <p>Unit of analysis: unclear as trial investigators did not report how 39 participants with both eyes included were analyzed</p> <p>Unit of randomization: unclear as trial investigators did not report whether 39 participants were assigned to the same or different groups</p> <p>Losses to follow-up: none reported</p> <p>How were missing data handled? no missing data reported</p> <p>Reported power calculation: no</p>
Participants	<p>Country: Turkey</p> <p>Mean age (SD): 64.5(NR) overall:</p> <p>61.5 (8.1) for the B-MICS with 1.2 to 1.4 trapezoidal/1.8-millimeter incision group</p> <p>65.8 (13.2) for the larger C-MICS group</p> <p>66.2 (12.6) for the standard phacoemulsification with 2.8-millimeter incision group</p> <p>Gender: 50 men and 46 women overall:</p> <p>14 men (44%) and 18 women (56%) in the B-MICS with 1.2 to 1.4 trapezoidal/1.8-millimeter incision group</p> <p>17 men (55%) and 14 women (45%) in the larger C-MICS group</p> <p>19 men (58%) and 14 women (42%) in the standard phacoemulsification with 2.8-millimeter incision group</p> <p>Inclusion criteria: not reported</p> <p>Exclusion criteria: previous ocular surgery or eye disease that might affect the final visual acuity (amblyopia, corneal scar, glaucoma, retinal or macular disorders, etc.)</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: B-MICS with 1.2 to 1.4 trapezoidal/1.8-millimeter incision group</p>

Can 2010 (Continued)

Intervention 2: larger C-MICS group

Intervention 3: standard phacoemulsification with 2.8-millimeter incision group

The type of IOL inserted was not reported.

Length of follow-up:

Planned: not reported

Actual: 90 days

Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined in study reports: VA, pachymetric differences, SIA, phacoemulsification time, CDE (i.e. average ultrasound power), and effective phaco time (time required had 100% power been used throughout), complications</p> <p>Adverse events reported: yes, 1 eye with capsule rupture in 2.8-millimeter group</p> <p>Intervals at which outcomes assessed: 1 day, 7 days, 30 days, and 90 days</p>
Notes	<p>Full study name: Coaxial, microcoaxial, and biaxial microincision cataract surgery prospective comparative study</p> <p>Type of study: published</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: No author has a financial or proprietary interest in any material or method mentioned.</p> <p>Study period: November 2006 to September 2008</p> <p>Trial registration: not reported</p> <p>We attempted to contact the authors but did not receive any response.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	The study did not report whether participants were masked.
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	The study did not report how many participants were followed at each time point.
Selective reporting (reporting bias)	Unclear risk	Protocol was not available. Trial registration not reported.

Can 2010 (Continued)

Other bias	Low risk	Source of funding not reported. Study investigators declared "no author has a financial or proprietary interest in any material or method mentioned" (p740).
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Capella 2010

Methods	<p>Study design: paired-eye RCT</p> <p>Number randomized: 74 eyes of 37 participants; 37 eyes of 37 participants per group</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: 72 eyes of 36 participants at 3 months; 36 eyes of 36 participants per group</p> <p>Unit of analysis: 1 eye of each participant</p> <p>Unit of randomization: both eyes of each participant included; 1 eye is randomized to smaller C-MICS and the other eye to standard phacoemulsification</p> <p>Losses to follow-up: 1 participant at 3 months</p> <p>How were missing data handled? excluded from analysis</p> <p>Reported power calculation: no</p> <p>Unusual study design: the study used paired-eye design, but did not used paired analysis.</p>
Participants	<p>Country: Spain</p> <p>Mean age (SD): 72.97 (NR) years overall; age not reported by group</p> <p>Age range: 52 to 84 years</p> <p>Gender: 12 men (32%) and 25 women (68%) overall; number per group not reported</p> <p>Inclusion criteria: over 50 years of age, bilateral senile cataracts intervened for cataract surgery in both eyes between September 2008 and April 2010</p> <p>Exclusion criteria: corneal pathology, previous ocular trauma or surgery, infectious and/or inflammatory ocular pathology, and astigmatism exceeding 3 diopters</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: smaller C-MICS</p> <p>Intervention 2: standard phacoemulsification with 2.8-millimeter incision</p> <p>Akreos MI60 IOL (Bausch & Lomb) was inserted for both groups.</p> <p>Length of follow-up:</p> <p>Planned: 3 months Actual: 3 months</p>
Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined by the study report: SIA, ECL, CCT, and foveal thickness</p> <p>Adverse events reported: no</p> <p>Intervals at which outcomes assessed: preoperatively and day 1, 1 week, 1 month, and 3 months after surgery</p>

Capella 2010 (Continued)

Notes

Full study name: Comparative study of coaxial microincision cataract surgery and standard phacoemulsification

Type of study: published

Funding sources: not reported

Disclosures of interest: not reported

Study period: September 2008 to April 2010

Trial registration: not reported

We emailed the authors and included data provided through email correspondence.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	The published reported stated that it was a prospective randomized study, but through email correspondence on 24 January 2017, the authors reported assigning treatment by "alternating one-by-one." From the published reported: "prospective and randomised study" (p269)
Allocation concealment (selection bias)	High risk	The published reported stated that it was a prospective randomized study, but through email correspondence the authors reported assigning treatment by "alternating one-by-one."
Masking of participants and personnel (performance bias)	High risk	We were informed through email correspondence that participants and personnel were not masked.
Masking of outcome assessment (detection bias)	High risk	We were informed through email correspondence that outcome assessors were not masked.
Incomplete outcome data (attrition bias) All outcomes	Low risk	1 out of 37 participants (less than 3%) lost to follow-up.
Selective reporting (reporting bias)	Unclear risk	The protocol was not available. Trial registration not reported. We were informed through email correspondence that the protocol was not published and the trial was not registered.
Other bias	Unclear risk	Source of funding and conflicts of interest not reported.

Dosso 2008

Methods

Study design: parallel-group RCT

Number randomized: 50 eyes of 50 participants total; 25 eyes of 25 participants in each group

Exclusions after randomization: none reported

Number analyzed: not reported, assumed to be 50 eyes of 50 participants total and 25 eyes of 25 participants in each group

Unit of analysis: 1 eye per participant

Unit of randomization: 1 eye per participant

Losses to follow-up: none reported

How were missing data handled? no missing data reported

Dosso 2008 (Continued)

Reported power calculation: no

Participants	<p>Country: Switzerland</p> <p>Mean age: 75 years overall:</p> <p>75 years for the C-MICS group</p> <p>75 years for the standard phacoemulsification group</p> <p>Gender: 22 men (41%) and 28 women (59%) in total:</p> <p>8 men (32%) and 17 women (68%) in the smaller C-MICS group</p> <p>14 men (53%) and 11 women (47%) in the standard phacoemulsification group</p> <p>Inclusion criteria: people who had nuclear or corticonuclear cataract of grade 2 to 4 according to the Lens Opacities Classification System III scale</p> <p>Exclusion criteria: people who had corneal pathology, inflammatory eye disease, glaucoma, previous ocular surgery or trauma, and endothelial cell density less than 1500 cells/mm²</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: smaller C-MICS with 1.6-millimeter incision; enlarged to 1.8 mm</p> <p>Intervention 2: standard phacoemulsification with 2.8-millimeter incision</p> <p>Lentis L-303 IOL (WaveLight GmbH) was inserted for both groups.</p> <p>Length of follow-up:</p> <p>Planned: not reported</p> <p>Actual: 8 weeks</p>
Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined in study reports: BCVA, CCT, and ECL</p> <p>Adverse events reported: no</p> <p>Intervals at which outcomes assessed: preoperatively and postoperatively at 1 and 8 weeks</p>
Notes	<p>Full study name: Outcomes of coaxial microincision cataract surgery versus conventional coaxial cataract surgery</p> <p>Type of study: published</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: Dr Di Nardo is an employee of Oertli Instrumente. No other author has a financial or proprietary interest in any material or method mentioned.</p> <p>Study period: January 2007 to March 2007</p> <p>Trial registration: not reported</p> <p>We attempted to contact the authors but the email was returned undeliverable.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"The participants were randomly assigned to have coaxial MICS or conventional coaxial phacoemulsification."; but sequence generation was not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported

Dosso 2008 (Continued)

Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	Not reported. Protocol not available. Trial registration not reported.
Other bias	Unclear risk	Source of funding and conflicts of interest not reported.

Febbraro 2015

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 190 eyes of 151 participants in total:</p> <p>63 eyes of 52 participants in the smaller C-MICS group</p> <p>66 eyes of 52 participants in the larger C-MICS group</p> <p>61 eyes of 47 participants in the standard phacoemulsification group</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: 190 eyes of 151 participants in total:</p> <p>63 eyes of 52 participants in the smaller C-MICS group</p> <p>66 eyes of 52 participants in the larger C-MICS group</p> <p>61 eyes of 47 participants in the standard phacoemulsification group</p> <p>Unit of analysis: mixed</p> <p>"As the original dataset included both unilateral and bilateral cases, we reported for each comparison the estimates obtained considering all evaluated eyes (unilateral and bilateral cases) and then repeated the analysis after restricting the data set to one eye per patient by choosing one eye randomly (via a computer-generated algorithm) in bilateral cases (data not shown)." (p262)</p> <p>Unit of randomization: 1 or both eyes per participant were assigned to the same treatment group.</p> <p>Losses to follow-up: none reported</p> <p>How were missing data handled? no missing data reported</p> <p>Reported power calculation: no</p>
Participants	<p>Country: not reported, assumed to be in France (all surgeries were performed by the same surgeon (JLF))</p> <p>Mean age: 75.1 (9.2) overall:</p> <p>76.6 (7.6) in the smaller C-MICS group</p> <p>73.9 (8.4) in the larger C-MICS group</p> <p>74.7 (11.3) in the standard phacoemulsification group</p> <p>Age range: not reported</p> <p>Gender: 93 women (62%) and 58 men (38%) overall:</p>

Febbraio 2015 (Continued)

35 women (67%) and 17 men (33%) in the smaller C-MICS group

37 women (71%) and 15 men (29%) in the larger C-MICS group

21 women (47%) and 26 men (53%) in the standard phacoemulsification group

Inclusion criteria: people undergoing cataract surgery

Exclusion criteria: "eyes with associated corneal, vitreous, or retinal pathologies" (p262)

Interventions	<p>Intervention 1: smaller C-MICS with MI 60 IOL (Bausch & Lomb, Rochester, NY, USA) inserted</p> <p>Intervention 2: larger C-MICS with AcrySof Natural SN60WF IOL (Alcon, Fort Worth, TX, USA) inserted</p> <p>Intervention 3: standard phacoemulsification (3.2-millimeter incision) with Adapt AO IOL (Bausch & Lomb, Rochester, NY, USA) inserted</p> <p>We considered standard phacoemulsification with incisions ranging from 2.75 to 3.2 mm to be about 3.0 mm.</p> <p>Length of follow-up:</p> <p>Planned: not reported</p> <p>Actual: 1 month</p>
Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined in study reports: keratometric astigmatism (using the same autokeratometer (Tonoref II; Nidek, Aichi, Japan); the Tonoref II measures the corneal curvature based on the projection onto the cornea of 4 near-infrared rays, scalar comparison of astigmatism, with-the-wound change, and against-the-wound change</p> <p>Adverse events reported: no</p> <p>Intervals at which outcomes assessed: 1 month</p>
Notes	<p>Full study name: Astigmatic equivalence of 2.2-mm and 1.8-mm superior clear corneal cataract incision</p> <p>Type of study: published full text</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: not reported</p> <p>Study period: not reported</p> <p>Trial registration: not reported</p> <p>We attempted to contact the authors but did not receive any response.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported

Febbraro 2015 (Continued)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	None of the participants were reported to have been lost to follow-up.
Selective reporting (reporting bias)	Unclear risk	Trial registry number and protocol were not reported, therefore we could not compare outcomes reported in the published full text and the trial registry/protocol.
Other bias	Unclear risk	Trial register number and funding sources were not reported.

Hui 2016

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 117 eyes of 85 participants in total:</p> <p>59 eyes of 43 participants in the smaller C-MICS group</p> <p>58 eyes of 42 participants in the standard phacoemulsification group</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: 85 participants with 117 eyes in total:</p> <p>59 eyes of 43 participants in the smaller C-MICS group</p> <p>58 eyes of 42 participants in the standard phacoemulsification group</p> <p>Unit of analysis: unclear as trial investigators did not report how 32 participants with both eyes included were analyzed</p> <p>Unit of randomization: unclear whether both eyes of the 32 participants were assigned to the same or different groups</p> <p>Losses to follow-up: none reported</p> <p>How were missing data handled? no missing data reported</p> <p>Reported power calculation: no</p>
Participants	<p>Country: China</p> <p>Mean age (SD): 64.1 (8.6) overall:</p> <p>64.8 (8.5) in the smaller C-MICS group</p> <p>63.3 (8.8) in the standard phacoemulsification group</p> <p>Gender: 40 men (47%) and 45 women (53%) overall:</p> <p>21 men (49%) and 22 women (51%) in the smaller C-MICS group</p> <p>19 men (45%) and 23 women (55%) in the standard phacoemulsification group</p> <p>Inclusion criteria: “(1)根据LOCSIII分级标准,晶状体核硬度为II~III级;(2)角膜屈光度<1.0 diopters;(3)眼轴22~24.5mm;(4)角膜内皮细胞密度>1500个/mm²。” (p1829)</p> <p>(1) people with cataract nucleus graded II-III, according to the Emery-Little classification; (2) corneal diopter less than 1.0 diopters; (3) axial lengths 22 to 24.5 mm; (4) endothelial cell density more than 1500 cells/mm²</p> <p>Exclusion criteria: “(1)角膜变性、葡萄膜炎、青光眼、高度近视眼、视神经病变、视网膜病变、年龄相关性黄斑变性、眼外伤病史、准分子激光手术和其他内眼手术史;(2)全身严重疾病史不能耐受手术者。” (p1829)</p> <p>(1) corneal degeneration, uveitis, glaucoma, high myopia, optic neuropathy, retinopathy, age-related macular degeneration, history of eye injury, history of LASIK; (2) history of systemic disorders that could not tolerate operation</p> <p>Equivalence of baseline characteristics: yes</p>

Hui 2016 (Continued)

Interventions	<p>Intervention 1: smaller C-MICS with Akreos MI60 IOL inserted</p> <p>Intervention 2: standard phacoemulsification with 3.2-millimeter incision with Adapt-AO IOL inserted</p> <p>Planned: not reported Actual: 90 days</p>
Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined in study reports: uncorrected VA, average ultrasound energy, effective phacoemulsification time, ECL, and corneal topography</p> <p>Adverse events reported: yes, temporary increase in intraocular pressure</p> <p>Intervals at which outcomes assessed: 1 day, 7 days, 30 days, 90 days for uncorrected VA, 90 days for other outcomes</p>
Notes	<p>Full study name: 同轴 1.8mm 微切口白内障超声乳化吸除术的临床研究</p> <p>[Clinical effects of coaxial 1.8 mm microincision phacoemulsification]</p> <p>Type of study: published full text</p> <p>Funding sources: 陕西省科学技术研究发展计划项目 [Shaanxi Province Science and Technology Research and Development Project (No. 2012K16-11(5))]</p> <p>Disclosures of interest: not reported</p> <p>Trial registry number: not reported</p> <p>Study period: December 2012 to March 2015</p> <p>We attempted to contact the authors but did not receive any response.</p>
Risk of bias	
Bias	Authors' judgement Support for judgement
Random sequence generation (selection bias)	Low risk “将患者按数字表法随机分为两组” [Participants were randomized into 2 groups using random number tables.] (p1829)
Allocation concealment (selection bias)	Unclear risk Not reported
Masking of participants and personnel (performance bias)	Unclear risk Not reported
Masking of outcome assessment (detection bias)	Unclear risk Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk No missing data were reported.
Selective reporting (reporting bias)	Unclear risk No protocol available for comparison.
Other bias	Unclear risk No disclosures of interest, no trial registry number, no protocol

Hwang 2008

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 60 eyes of 55 participants overall:</p> <p>30 eyes of 28 participants in the larger C-MICS group</p> <p>30 eyes of 27 participants in the standard phacoemulsification group</p> <p>Number randomized: 55 participants of 60 eyes overall:</p> <p>30 eyes of 28 participants in the larger C-MICS group</p> <p>30 eyes of 27 participants in the standard phacoemulsification group</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: unclear, assumed to be:</p> <p>60 eyes of 55 participants overall:</p> <p>30 eyes of 28 participants in the larger C-MICS group</p> <p>30 eyes of 27 participants in the standard phacoemulsification group</p> <p>Unit of analysis: unclear, as trial investigators did not report how 5 participants with both eyes included were analyzed</p> <p>Unit of randomization: unclear whether both eyes of the 5 participants were assigned to the same or different groups</p> <p>Losses to follow-up: none reported</p> <p>How were missing data handled? no missing data reported</p> <p>Reported power calculation: no</p>
Participants	<p>Country: South Korea</p> <p>Overall mean age: not reported</p> <p>Mean age (SD): 69.7 (NR) overall:</p> <p>70.6 (9.2) in the larger C-MICS group</p> <p>68.8 (7.6) in the standard phacoemulsification group</p> <p>Age range: not reported</p> <p>Gender: 13 men and 15 women in the larger C-MICS group; 11 men and 16 women in the standard phacoemulsification group</p> <p>Inclusion criteria: not reported</p> <p>Exclusion criteria: "patients with corneal disease, intraocular inflammation, glaucoma, and those who had previously undergone corneal surgery or surgery that could affect high-order aberrations were excluded" (p1598)</p>
Interventions	<p>Intervention 1: larger C-MICS</p> <p>Intervention 2: standard phacoemulsification (2.8 mm)</p> <p>We considered standard phacoemulsification with incisions ranging from 2.75 to 3.2 mm to be about 3.0 mm.</p> <p>SA60AT IOL (AcrySof; Alcon, USA) was inserted for both groups.</p>

Hwang 2008 (Continued)

Length of follow-up:

Planned: protocol not available
Actual: 3 months

Outcomes	<p>Primary outcome, as defined in study reports: SIA</p> <p>Secondary outcomes, as defined in study reports:</p> <p>Postoperative change of corneal higher-order aberrations in each group at 1 month or 3 months after surgery</p> <p>Corneal higher-order aberrations between the 2 groups preoperatively, at 1 month or 3 months after surgery</p> <p>Adverse events reported: not reported</p> <p>Intervals at which outcomes assessed: baseline, 1 month and 3 months</p>
Notes	<p>Type of study: published full text</p> <p>Funding sources: Inje University</p> <p>Disclosures of interest: not reported</p> <p>Trial registry number: not reported</p> <p>Study period: July 2006 to December 2006</p> <p>We attempted to contact the authors but the email was returned undeliverable.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	The protocol was not available. Trial registration not reported.
Other bias	Unclear risk	Source of funding and conflicts of interest not reported.

Hwang 2016

Methods	Study design: paired-eye RCT
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Hwang 2016 (Continued)

Number randomized: 42 participants with 42 eyes in total:

42 eyes of 42 participants in the larger C-MICS group

42 eyes of 42 participants in the standard phacoemulsification group

Exclusions after randomization: none reported

Number analyzed: 42 participants with 42 eyes in total:

42 eyes of 42 participants in the larger C-MICS group

42 eyes of 42 participants in the standard phacoemulsification group

Unit of analysis: 1 eye per participant

Unit of randomization: 1 eye per participant

Losses to follow-up: none reported

How were missing data handled? not reported

Reported power calculation: none reported

Unusual study design: the study randomized participants and included both eyes of the same participant in the same intervention, but they did not account for intraperson correlation.

Participants	<p>Country: Korea</p> <p>Mean age (SD): 65.20 (NR) overall:</p> <p>64.52 (10.65) in the larger C-MICS group</p> <p>65.87 (12.91) in the standard phacoemulsification group</p> <p>Gender: not reported</p> <p>Inclusion criteria: "patients with nuclear density from Grade 3–4, a dilated pupil of 7.0 mm or larger, and a corneal endothelial cell count (ECC) >2000 cells/mm²." (p190)</p> <p>Exclusion criteria: "patients with history of uveitis or other intra-ocular inflammation diseases, topical prostaglandin users, and intraoperative complications such as posterior lens capsule rupture and lens dislocation" (p190)</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: larger C-MICS group</p> <p>Intervention 2: standard phacoemulsification (2.75 mm) group</p> <p>MI60 IOL (Bausch & Lomb, Rochester, NY, USA) was inserted for both groups.</p> <p>Length of follow-up:</p> <p>Planned: not reported</p> <p>Actual: 2 months</p>
Outcomes	<p>Primary outcome, as defined in study reports:</p> <p>"1. Intraoperative measurements included:</p> <p>1.1. Ultrasound time (UST)</p> <p>1.2. Mean cumulative dissipated ultrasound energy (CDE)</p> <p>1.3. Total balanced salt solution (BSS) use</p> <p>2. Clinical measurements included preoperative, 1week postoperative, 1month postoperative and 2-month postoperative:</p> <p>2.1. Best corrected visual acuity (BCVA)</p> <p>2.2. Central corneal thickness (CCT)</p> <p>2.3. Endothelial cell count (ECC)"</p> <p>Secondary outcomes, as defined in study reports: enzymelinked immunosorbent assay (ELISA) and reverse transcription polymerase chain reaction (RT-PCR) were performed for IL-1α, IL-6, VEGF, and PGE2 preoperatively and at 1 week postoperatively.</p> <p>Adverse events reported: not reported</p>

Hwang 2016 (Continued)

Intervals at which outcomes assessed: 1 day, 1 week, 1 month, and 2 months

Notes

Full study name: Comparison of macular thickness and inflammatory cytokine levels after microincision versus small incision coaxial cataract surgery

Type of study: published full text

Funding sources: "Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Science, ICT & Future Planning (No. 2012R1A1A1038648) and the Institute of Clinical Medicine Research of Bucheon St. Mary's Hospital, Research Fund, BCM-C14AA07" (p194)

Disclosures of interest: not reported

Trial registry number: ISRCTN 69290731

Study period: not reported

We attempted to contact the authors but did not receive any response.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Low risk	"One examiner was masked as to whether the images were from the microincision group or the small incision group." (p191)
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	None of the participants were reported to have been lost to follow-up.
Selective reporting (reporting bias)	Low risk	All the outcomes in the registry have been reported.
Other bias	Unclear risk	Disclosures of interest were not reported.

Jeong 2013

Methods

Study design: parallel-group RCT

Number randomized: 144 eyes of 96 participants overall:

72 eyes of NR participants in the larger C-MICS group

72 eyes of NR participants in the standard phacoemulsification group

Exclusions after randomization: none reported, assumed to be none

Number analyzed: 144 eyes of 96 participants overall:

Jeong 2013 (Continued)

	<p>72 eyes of NR participants in the larger C-MICS group</p> <p>72 eyes of NR participants in the standard phacoemulsification group</p> <p>Unit of analysis: unclear as trial investigators did not report how 48 participants with both eyes included were analyzed</p> <p>Unit of randomization: unclear whether both eyes of the 48 participants were assigned to the same or different groups</p> <p>Losses to follow-up: none reported</p> <p>How were missing data handled?: no missing data reported</p> <p>Reported power calculation: no</p>
Participants	<p>Country: South Korea</p> <p>Mean age (SD): 71.49 (NR) overall: 72.30 (10.85) in C-MICS group 70.67 (8.27) in standard phacoemulsification group</p> <p>Age range: not reported</p> <p>Gender: not reported</p> <p>Inclusion criteria: people with cataract; no specific description</p> <p>Exclusion criteria: "patients with a history of preoperative corneal surgery, patients with diabetic retinopathy or iritis, and those who were previously diagnosed with keratopathy were excluded. The posterior capsular rupture or vitreous loss was excluded from the study." (p709)</p>
Interventions	<p>Intervention 1: larger C-MICS</p> <p>Intervention 2: standard phacoemulsification with 2.8-millimeter incision</p> <p>We considered standard phacoemulsification with incisions ranging from 2.75 to 3.2 mm to be about 3.0 mm.</p> <p>MI-60 IOL (Bausch & Lomb, Rochester, NY, USA) was inserted for both groups.</p> <p>Length of follow-up:</p> <p>Planned: not available Actual: 1 month</p>
Outcomes	<p>Primary outcome, as defined in study reports: total UST, CDE, average torsional amplitude, fluid amount, case time, CCT increase</p> <p>Secondary outcomes, as defined in study reports: ultrasound dynamic parameters measured during surgery and edema</p> <p>Adverse events reported: yes, burning of the cornea, no postoperative infection or persistent inflammation</p> <p>Intervals at which outcomes assessed: baseline, 1 day, and 1 month</p>
Notes	<p>Type of study: published full text</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: not reported</p> <p>Trial registry number: not reported</p>

Jeong 2013 (Continued)

Study period: not reported

We attempted to contact the authors but did not receive any response.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	Authors may have not reported an outcome due to difficulty assigning it. "To assess corneal stress after surgery, it may be helpful to measure the density of endothelial cells and measure the thickness and recovery pattern of the corneal incision site. In the present study, it was difficult to measure endothelial cells in the presence of central corneal edema 1 day after surgery. Therefore, there is a limitation that it is excluded."
Other bias	Unclear risk	Source of funding and conflicts of interest not reported.

Li 2011

Methods

Study design: parallel-group RCT

Number randomized: 76 eyes of 71 participants in total:

37 eyes of NR participants in the larger C-MICS group

39 eyes of NR participants in the standard phacoemulsification group

Exclusions after randomization: none reported

Number analyzed: not reported, assumed to be:

76 eyes of 71 participants total; 37 eyes in the larger C-MICS group

39 eyes in the standard phacoemulsification group

Unit of analysis: unclear as trial investigators did not report how 5 participants with both eyes included were analyzed

Unit of randomization: unclear whether both eyes of the 5 participants were assigned to the same or different groups

Losses to follow-up: none reported

Different-sized incisions for phacoemulsification in age-related cataract (Review)

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Li 2011 (Continued)

How were missing data handled? no missing data reported

Reported power calculation: no

Participants	<p>Country: Korea</p> <p>Mean age: overall 68.53 years: 66.83 years in the larger C-MICS group 69.25 years in the standard phacoemulsification group</p> <p>Age range: 57 to 85 overall</p> <p>Gender: 39 men (55%) and 32 women (45%) overall; number per group not reported</p> <p>Inclusion criteria: age-related cataracts included eyes with grade II-IV nuclear cataracts (Lens Opacities Classification System (LOCS) III)</p> <p>Exclusion criteria: "presence of pre-existing corneal disease or degeneration, an incision that required enlarging to insert an IOL, and complicated or excessively prolonged surgery"</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: larger C-MICS</p> <p>Intervention 2: standard phacoemulsification with 2.8-millimeter incision</p> <p>They type of IOL was not reported; "in both the 2.2 and 2.8 mm groups, the IOL type and the IOL injector system were matched, except for the incision size, to minimize bias." (p201)</p> <p>Length of follow-up:</p> <p>Planned: 1 month Actual: 1 month</p>
Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined in study reports: CDE, UST, ECL, and CCT</p> <p>Adverse events reported: not reported</p> <p>Intervals at which outcomes assessed: 1 day before surgery, and postoperatively at 1 day, 1 week, and 1 month</p>
Notes	<p>Full study name: Early changes in corneal edema following torsional phacoemulsification using anterior segment optical coherence tomography and Scheimpflug photography</p> <p>Type of study: published</p> <p>Funding sources: Korea Healthcare Technology R&D Project, Ministry for Health Welfare & Family Affairs, Republic of Korea (A 090573)</p> <p>Disclosures of interest: not reported</p> <p>Study period: May to July 2009</p> <p>Trial registration: not reported</p> <p>We attempted to contact the authors but did not receive any response.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
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Different-sized incisions for phacoemulsification in age-related cataract (Review)

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Li 2011 (Continued)

Random sequence generation (selection bias)	Unclear risk	The study mentioned that participants were randomized, but did not specify methods for random sequence generation.
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	Protocol not reported. Trial registration not reported.
Other bias	Low risk	Source of funding reported, conflicts of interest not reported. "This work was supported by the Korea Healthcare Technology R&D Project, Ministry for Health Welfare & Family Affairs, Republic of Korea (A 090573)." (p203)

Li 2016

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 90 eyes of 90 participants in total; 45 eyes of 45 participants in each group</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: 90 eyes of 90 participants in total; 45 eyes of 45 participants in each group</p> <p>Unit of analysis: 1 eye per participant</p> <p>Unit of randomization: 1 eye per participant</p> <p>Losses to follow-up: none reported</p> <p>How were missing data handled? no missing data reported</p> <p>Reported power calculation: no</p> <p>Unusual study design: none</p>
Participants	<p>Country: China</p> <p>Mean age (SD): 64.1 (8.6) overall:</p> <p>51.5 (4.2) in C-MICS 2.2 mm and IOL implantation group</p> <p>50.2 (3.9) in standard phacoemulsification 3.0 mm and IOL implantation group</p> <p>Age range: 45 to 62 overall:</p> <p>45 to 62 in coaxial C-MICS 2.2 mm and IOL implantation group</p> <p>46 to 61 in standard phacoemulsification 3.0 mm and IOL implantation group</p> <p>Gender: 49 men and 41 women overall:</p> <p>25 men (56%) and 20 women (44%) in C-MICS 2.2 mm and IOL implantation group</p> <p>24 men (53%) and 21 women (47%) in standard phacoemulsification 3.0 mm and IOL implantation group</p> <p>Inclusion criteria: "patients receiving phacoemulsification cataract extraction surgeries" (p81)</p>

Li 2016 (Continued)

Exclusion criteria: "other eye diseases, severe autoimmune system diseases, and systemic connective tissue diseases" (p81)

Equivalence of baseline characteristics: yes

Interventions	<p>Intervention 1: C-MICS 2.2 mm and IOL implantation</p> <p>Intervention 2: standard phacoemulsification 3.0 mm and IOL implantation</p> <p>Akreos MI60 IOL was inserted for both groups.</p> <p>Length of follow-up:</p> <p>Planned: not reported</p> <p>Actual: 30 days</p>
Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined in study reports: dry eye symptom score, break-up time, Schirmer's 1 test, and corneal fluorescein staining score</p> <p>Adverse events reported: yes, temporary increase in intraocular pressure</p> <p>Intervals at which outcomes assessed: 10, 20, 30 days</p>
Notes	<p>Full study name: Changes of the ocular surface and tear film after clear corneal incision phacoemulsification with different incision sizes</p> <p>Type of study: published full text</p> <p>Funding sources: "海南省卫生厅科研项目(No.琼卫2012PT-28)作者单位:(570102)中国海南省海口市,海南医学院附属医院眼科" (p80)</p> <p>Research of Hainan Provincial Health Department (No.琼卫2012PT-28)</p> <p>Disclosures of interest: not reported</p> <p>Study period: May 2013 to May 2014</p> <p>Trial registration: not reported</p> <p>We attempted to contact the authors but did not receive any response.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported

Different-sized incisions for phacoemulsification in age-related cataract (Review)

Li 2016 (Continued)

Selective reporting (re-reporting bias)	Unclear risk	Protocol not reported. Trial registration not reported.
Other bias	Low risk	Source of funding reported, conflicts of interest not reported "海南省卫生厅科研项目(No. 琼卫2012PT-28) 作者单位:(570102)中国海南省海口市,海南医学院附属医院 眼科" (p80)

Lin 2013

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 78 eyes of 56 participants in total:</p> <p>38 eyes of NR participants in the larger C-MICS group</p> <p>40 eyes of NR participants in the standard phacoemulsification (3.0-millimeter incision) group</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: not reported, assumed to be:</p> <p>78 eyes of 56 participants in total:</p> <p>38 eyes of NR participants in the larger C-MICS group</p> <p>40 eyes of NR participants in the standard phacoemulsification (3.0-millimeter incision) group</p> <p>Unit of analysis: unclear as trial investigators did not report how 22 participants with both eyes included were analyzed</p> <p>Unit of randomization: unclear whether both eyes of the 22 participants were assigned to the same or different groups</p> <p>Losses to follow-up: not reported</p> <p>How were missing data handled? not reported</p> <p>Reported power calculation: no</p> <p>Unusual study design: the study randomized participants and included both eyes of the same participant in the same intervention, but they did not account for intraperson correlation.</p>
Participants	<p>Country: China</p> <p>Mean age: 71.3 years overall: not reported by group</p> <p>Gender: not reported</p> <p>Inclusion criteria: "诊断为老年性白内障, 患者年龄大于50岁, 裂隙灯下观察见患眼晶状体混浊。术前检查角膜内皮细胞计数大于1200个/mm²。" (p1465)</p> <p>age-related cataract with age over 50 with preoperation endothelial cell count larger than 1200/mm²</p> <p>Exclusion criteria: "排除增殖期糖尿病视网膜病变、青光眼、老年性黄斑变性等眼部疾病及既往有内眼手术史的患者。术中出现后囊膜破裂、玻璃体溢出等并发症者、不能完成3mo随访者予以剔除。" (p1465)</p> <p>diabetic retinopathy, glaucoma, age-related macular degeneration, previous operation, posterior capsule rupture during surgery, vitreous loss in the surgery</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: C-MICS (2.2-millimeter incision)</p> <p>Intervention 2: standard phacoemulsification (3.0-millimeter incision)</p> <p>SN60WF IOL (Alcon) was inserted for both groups.</p> <p>Length of follow-up:</p>

Lin 2013 (Continued)

	Planned: not reported
	Actual: 3 months
Outcomes	Primary and secondary outcomes were not differentiated. Outcomes, as defined in the study reports: uncorrected VA, BCVA, corneal astigmatism, SIA
Notes	<p>Full study name: 同轴微切口白内障超声乳化术后角膜散光的临床观察</p> <p>Observation of corneal astigmatism induced by 2.2-millimeter microincision coaxial phacoemulsification</p> <p>Type of study: published full text</p> <p>Funding sources: 佛山市卫生局医学科研立项课题 (No. 2011162)</p> <p>Medical scientific research program of Foshan board of health (No. 2011162)</p> <p>Disclosures of interest: not reported</p> <p>Trial registry number: not reported</p> <p>Study period: January to September 2011</p> <p>We attempted to contact the authors but did not receive any response.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	<p>“将患者按就诊顺序登记并按随机表法分成两组,分别施行 2.2mm 同轴微切口白内障超声乳化联合 IOL 植入术及 3.0mm 常规白内障超声乳化联合 IOL 植入术,其中 2.2mm 组 38 眼,3.0mm 组 40 眼。</p> <p>“排除增殖期糖尿病视网膜病变、青光眼、老年性黄斑变性等眼部疾病及既往有内眼手术史的患者。术中出现后囊膜破裂、玻璃体溢出等并发症者、不能完成 3mo 随访者予以剔除。” (p1465)</p> <p>Randomized table was used to distribute the participants into different groups. Diabetic retinopathy, glaucoma, age-related macular degeneration, previous operation, posterior capsule rupture during surgery, vitreous loss in the surgery. Postrandomization exclusions exist.</p>
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	High risk	Participants were excluded postrandomization.
Selective reporting (reporting bias)	Unclear risk	Trial registry number and protocol were not available for comparison.

Lin 2013 (Continued)

Other bias	Unclear risk	Funding sources and disclosures of interests were not reported.
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Luo 2012

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 120 eyes of 120 participants total; 40 eyes of 40 participants per group</p> <p>Exclusions after randomization: none</p> <p>Number analyzed: 120 eyes of 120 participants total; 40 eyes of 40 participants per group</p> <p>Unit of analysis: 1 eye per participant</p> <p>Unit of randomization: 1 eye per participant</p> <p>Losses to follow-up: none reported</p> <p>How were missing data handled? no missing data</p> <p>Reported power calculation: no</p> <p>Unusual study design: no</p>
Participants	<p>Country: China</p> <p>Mean age: overall mean age not reported; 73.95 years for 1.8 mm; 71.37 years for 2.2 mm; 72.48 years for 3.0 mm</p> <p>Gender: 58 men and 62 women overall;</p> <p>21 men (53%) and 19 women (47%) in the smaller C-MICS group</p> <p>18 men (45%) and 22 women (55%) in the C-MICS (2.2-millimeter incision) group</p> <p>19 men (47%) and 21 women (53%) in the standard phacoemulsification (3.0-millimeter incision) group</p> <p>Inclusion criteria: age between 55 and 85 years, the presence of nuclear or corticonuclear cataract of grades 2.0 to 4.0 (Lens Opacities Classification System III), a transparent central cornea, pupil dilation 7 mm at the time of preoperative examination, and a preoperative central endothelial cell count of 1500 cells/mm²</p> <p>Exclusion criteria: previous intraocular surgery, glaucoma, pseudoexfoliation, uveitis, high myopia, and diabetes mellitus</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: smaller C-MICS group with Akreos MI 60 IOL (Bausch & Lomb) inserted</p> <p>Intervention 2: C-MICS (2.2-millimeter incision) group with SN60WF IOL (Alcon) inserted</p> <p>Intervention 3: standard phacoemulsification (3.0-millimeter incision) group with SA60AT IOL (Alcon) inserted</p> <p>We considered standard phacoemulsification with incisions ranging from 2.75 to 3.2 mm to be about 3.0 mm.</p> <p>Length of follow-up:</p> <p>Planned: 3 months</p> <p>Actual: 3 months</p>

Luo 2012 (Continued)

Outcomes

Primary outcome, as defined in study reports: UST, surgical time, CDE and the total BSS volume, intraoperative measurements of corneal incision size during surgery, change in maximal clear corneal incision thickness as evaluated by AS-OCT, BCVA, central cornea ECL, and SIA

Secondary outcomes, as defined in study reports: primary and secondary outcomes not differentiated

Adverse events reported: no

Intervals at which outcomes assessed: postoperatively at 1 day, 1 week, 1 month, 3 months

Notes

Full study name: Clinical evaluation of three incision size-dependent phacoemulsification systems

Type of study: published

Funding sources: Natural Science Foundation of China (30973277) and the Key Projects for Hospital Clinical Disciplines Fund of the Chinese Ministry of Health in 2010–2012 (Project No.175 in Document 439 of the Planning and Finance Secretary of Ministry of Health, China)

Disclosures of interest: "The authors indicate no financial conflict of interest."

Study period: July 2010 to January 2011

Trial registration: NCT01429532 (ClinicalTrials.gov)

We attempted to contact the authors but the email was returned undeliverable.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"A number between 1 and 120, generated by a random number generator, was assigned to each subject. The number was divided by 3. If the remainder was 1, the patient was assigned to Group I; if the remainder was 2, the patient was assigned to Group II; and if the number was divisible by 3, the patient was assigned to Group III."
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Low risk	"Both the technician and the surgeon were masked during postoperative examinations to the participants' group assignment."
Incomplete outcome data (attrition bias) All outcomes	Low risk	"All participants completed all follow-up visits."
Selective reporting (reporting bias)	Low risk	This clinical trial has been registered at www.clinicaltrials.gov , registration number NCT01429532. All outcomes were reported.
Other bias	Low risk	Source of funding and conflicts of interest reported. "Publication of this clinical study was supported by the Natural Science Foundation of China (30973277)" (p838) "The authors indicate no financial conflict of interest." (p838)

Mao 2008

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 160 eyes of 160 participants total; 80 eyes of 80 participants in each group</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: 160 eyes of 160 participants; 80 eyes of 80 participants in each group</p> <p>Unit of analysis: 1 eye per participant</p> <p>Unit of randomization: 1 eye per participant</p> <p>Losses to follow-up: none at 1 month</p> <p>How were missing data handled? not reported</p> <p>Reported power calculation: no</p> <p>Unusual study design: no</p>
Participants	<p>Country: China</p> <p>Mean age (SD): 69 (NR) overall; not reported by group</p> <p>Age range: 48 to 82 years</p> <p>Gender: 84 men (52%) and 76 women (48%) overall; number per group not reported</p> <p>Inclusion criteria: age-related cataract</p> <p>Exclusion criteria: people with glaucoma, diabetes, or other eye diseases were excluded</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: B-MICS (1.4-millimeter incision) group with Acri.Smart46s (Acti.Tec) IOL inserted</p> <p>Intervention 2: standard phacoemulsification (3.0-millimeter incision) group with SENSER IOL (AMO) inserted.</p> <p>We considered standard phacoemulsification with incisions ranging from 2.75 to 3.2 mm to be about 3.0 mm.</p> <p>Length of follow-up:</p> <p>Planned: not reported</p> <p>Actual: 1 month</p>
Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined in study reports: uncorrected VA and SIA</p> <p>Adverse events reported: yes, corneal edema</p> <p>Intervals at which outcomes assessed: preoperatively and postoperatively at 1 day, 1 week, and 1 month</p>
Notes	<p>Full study name: Analysis of the visual quality after bimanual phacoemulsification via micro-incision</p> <p>Type of study: published</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: not reported</p> <p>Study period: August 2005 to February 2006</p>

Mao 2008 (Continued)

Trial registration: not reported

We attempted to contact the authors but the email was returned undeliverable.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	Protocol was not available. Trial registration not reported.
Other bias	Unclear risk	Source of funding and conflicts of interest not reported.

Mastropasqua 2011

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 30 eyes of 30 participants; 15 eyes of 15 participants per group</p> <p>Exclusions after randomization: not reported</p> <p>Number analyzed: not reported</p> <p>Unit of analysis: 1 eye per participant</p> <p>Unit of randomization: 1 eye per participant</p> <p>Losses to follow-up: none</p> <p>How were missing data handled? not reported</p> <p>Reported power calculation: no</p> <p>Unusual study design? none</p>
Participants	<p>Country: Italy</p> <p>Mean age (SD): 69.8 (NR) overall: 70.11 (NR) smaller C-MICS group 69.44 (NR) C-MICS (2.2-millimeter incision) group</p>

Mastropasqua 2011 (Continued)

Gender: not reported

Inclusion criteria: age 65 to 75 years, axial length 23.0 to 24.0 mm, corneal astigmatism less than 3.00 diopters, nuclear cataract of grade 4 (nuclear opalescence - NO4, Lens Opacities Classification System III), and corneal endothelial cell count greater than 1200/mm²

Exclusion criteria: anterior segment pathological alterations such as keratoconus, chronic uveitis, zonular dialysis, pseudoexfoliation syndrome, glaucoma, and diabetes mellitus; other ocular pathologies impairing visual function; previous anterior or posterior segment surgery; and intraoperative or postoperative complications

Equivalence of baseline characteristics: yes

Interventions	<p>Intervention 1: smaller C-MICS</p> <p>Intervention 2: C-MICS (2.2-millimeter incision)</p> <p>AcrySof SN60WF IOL (Alcon) was inserted for both groups.</p> <p>Length of follow-up:</p> <p>Planned: not reported Actual: 90 days</p>
Outcomes	<p>Primary outcome, as defined in study reports: uncorrected VA and BCVA, keratometric astigmatism, endothelial cell count, and corneal thickness at incision site. The amount and axis of astigmatic change induced by the cataract surgery were assessed by calculating the SIA. Power vector analysis of keratometric astigmatic change between preoperative and postoperative values was performed.</p> <p>Secondary outcomes, as defined in study reports: intraoperative parameters including mean torsional time, CDE, and BSS used</p> <p>Adverse events reported: not reported</p> <p>Intervals at which outcomes assessed: postoperatively at 1 day, 7 days, 30 days, and 90 days</p>
Notes	<p>Full study name: Microcoaxial torsional cataract surgery 1.8 mm versus 2.2 mm: functional and morphological assessment</p> <p>Type of study: published</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: the authors have no financial or proprietary interest in the materials</p> <p>Study period: not reported</p> <p>Trial registration: not reported</p> <p>We attempted to contact the authors but did not receive any response.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Participants were randomly assigned to group 1 or group 2 the day before surgery by block randomization (randomly assigned by computer-generated numbers)"
Allocation concealment (selection bias)	Unclear risk	Not reported

Mastropasqua 2011 (Continued)

Masking of participants and personnel (performance bias)	Low risk	"Participants and examiners performing preoperative and postoperative controls were masked to the surgical technique used in each case"
Masking of outcome assessment (detection bias)	Low risk	"Participants and examiners performing preoperative and postoperative controls were masked to the surgical technique used in each case"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	Protocol was not available. Trial registration not reported.
Other bias	Low risk	Source of funding not reported. "The authors have no financial or proprietary interest in the materials presented herein." (p114)

Moon 2011

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 100 eyes of 89 participants overall:</p> <p>32 eyes of NR participants in the smaller C-MICS group</p> <p>38 eyes of NR participants in C-MICS (2.2-millimeter incision) group</p> <p>30 eyes of NR participants in standard phacoemulsification with 2.8-millimeter incision group</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: 100 eyes of 89 participants overall:</p> <p>32 eyes of NR participants in the smaller C-MICS group</p> <p>38 eyes of NR participants in C-MICS (2.2-millimeter incision) group</p> <p>30 eyes of NR participants in standard phacoemulsification with 2.8-millimeter incision group</p> <p>Unit of analysis: unclear as trial investigators did not report how 11 participants with both eyes included were analyzed</p> <p>Unit of randomization: unclear whether both eyes of the 11 participants were assigned to the same or different groups</p> <p>Losses to follow-up: none reported</p> <p>How were missing data handled? no missing data reported</p> <p>Reported power calculation: no</p>
Participants	<p>Country: South Korea</p> <p>Mean age (SD): 65.2 (NR) overall:</p> <p>64.5 (10.5) years old in the smaller C-MICS group</p> <p>61.8 (15.3) years old in C-MICS (2.2-millimeter incision) group</p> <p>69.4 (10.0) years old in standard phacoemulsification with 2.8-millimeter incision group</p>

Moon 2011 (Continued)

Age range: not reported

Gender: 30 men and 59 women total; number per group not reported

Inclusion criteria: "the subjects with corneal astigmatism less than 2.25 diopters were examined" (p408)

Exclusion criteria: "the patients who underwent corneal surgery including refractive surgery, eyes that can not measure the corneal curvature due to corneal opacity, surgery that affects corneal astigmatism during surgery, or other types of intraocular lenses were excluded from the study." (p408)

Interventions

Intervention 1: smaller C-MICS with MI60 IOL (Bausch & Lomb, Rochester, NY, USA)

Intervention 2: C-MICS (2.2-millimeter incision) with AcrySof IQ IOL (Alcon, Fort Worth, TX, USA)

Intervention 3: standard phacoemulsification (2.8-millimeter incision) with Akreos AO IOL (Bausch & Lomb)

We considered standard phacoemulsification with incisions ranging from 2.75 to 3.2 mm to be about 3.0 mm.

Length of follow-up:

Planned: no protocol available

Actual: baseline, 1 and 3 months

Outcomes

Primary outcome, as defined in study reports: SIA and high-order aberrations (coma, trefoil, and spherical aberration)

Secondary outcomes, as defined in study reports: coma-root mean square (RMS) and trefoil-RMS were evaluated at 1 month after the cataract operation.

Adverse events reported: no

Intervals at which outcomes assessed: baseline, 1 and 3 months

Notes

Type of study: published full text

Funding sources: not reported

Disclosures of interest: not reported

Study period: March 2009 to August 2009

Trial registry number: not reported

We attempted to contact the authors but did not receive any response.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported

Moon 2011 (Continued)

Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	Protocol was not available. Trial registration not reported.
Other bias	Unclear risk	Funding sources, disclosures of interests were not reported.

Morcillo-Laiz 2009

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 94 eyes of 64 participants total; 43 eyes in standard phacoemulsification group, 51 eyes in B-MICS group</p> <p>Exclusions after randomization: none</p> <p>Number analyzed: 94 eyes of 64 participants; 43 eyes in standard phacoemulsification group, 51 in B-MICS group</p> <p>Unit of analysis: unclear as trial investigators did not report how 30 participants with both eyes included were analyzed</p> <p>Unit of randomization: unclear whether both eyes of the 30 participants were assigned to the same or different groups</p> <p>Losses to follow-up: standard phacoemulsification group had none reported at 1 month, 3 participants at 3 months and 5 participants at 6 months; B-MICS had none reported at 1 month, 3 participants at 3 months, and 3 participants at 6 months.</p> <p>How were missing data handled? not reported</p> <p>Reported power calculation: no</p> <p>Unusual study design? no</p>
Participants	<p>Country: Spain</p> <p>Mean age (SD): 70.53 (NR) overall: 69.02 (NR) years for standard phacoemulsification 72.04 (NR) years for B-MICS</p> <p>Gender: 24 men (37%) and 40 women (63%) overall; number not reported by group</p> <p>Inclusion criteria: people scheduled for elective cataract surgery</p> <p>Exclusion criteria: topographic astigmatism 42.0 diopters, intraoperative use of corneal sutures, or corneal disease</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: B-MICS (1.5- to 2-millimeter incision) with Acri.Smart 48S IOL (Acri.Tec, Hennigsdorf, Germany) inserted</p>

Morcillo-Laiz 2009 (Continued)

Intervention 2: standard phacoemulsification (2.8-millimeter incision) with Y601075 (AJL, A1ava, Spain)

Length of follow-up:

Planned: not reported

Actual: 6 months

Outcomes	<p>Primary outcome, as defined in study reports: SIA and BCVA</p> <p>Secondary outcomes, as defined in study reports: not reported</p> <p>Adverse events reported: not reported</p> <p>Intervals at which outcomes assessed: preoperatively and postoperatively at 1, 3, and 6 months</p>
Notes	<p>Full study name: Surgically induced astigmatism after biaxial phacoemulsification compared to coaxial phacoemulsification</p> <p>Type of study: published</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: no</p> <p>Study period: not reported</p> <p>Trial registration: not reported</p> <p>We attempted to contact the authors but the email was returned undeliverable.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	The study mentioned that participants were randomized, but did not specify methods for random sequence generation.
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Low risk	"Neither the patient nor the examiner knew which technique had been applied."; double-blind clinical trial
Masking of outcome assessment (detection bias)	Low risk	"Neither the patient nor the examiner knew which technique had been applied."
Incomplete outcome data (attrition bias) All outcomes	Low risk	8 out of 94 participants (9.6%) were lost to follow-up at 6 months.
Selective reporting (reporting bias)	Unclear risk	Protocol was not available. Trial registration not reported.
Other bias	Unclear risk	Source of funding and conflicts of interest not reported.

Musanovic 2012

Methods	<p>Study design: paired-eye RCT</p> <p>Number randomized: 60 eyes of 30 participants in total; 30 eyes of 30 participants per group</p> <p>Exclusions after randomization: not reported</p> <p>Number analyzed: not reported, assumed to be 60 eyes of 30 participants in total; 30 eyes of 30 participants per group</p> <p>Unit of analysis: 1 eye per participant</p> <p>Unit of randomization: 1 eye per participant</p> <p>Losses to follow-up: not reported</p> <p>How were missing data handled? not reported</p> <p>Reported power calculation: no</p> <p>Unusual study design: none</p>
Participants	<p>Country: Bosnia and Herzegovina</p> <p>Mean age (SD): 63.6 (NR) overall: 65.13 (NR) in standard phacoemulsification (3.0-millimeter incision) group 62.06 (NR) in the larger C-MICS group</p> <p>Gender: not reported</p> <p>Inclusion criteria: people from everyday operational program cataract surgery at the Eye Clinic of University Clinical Center Tuzla in the period of October 2009 to December 2009. People planned for cataract surgery and who met the inclusion criteria of the study were included.</p> <p>Exclusion criteria: not reported</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: standard phacoemulsification (3.0-millimeter incision)</p> <p>Intervention 2: larger C-MICS</p> <p>The type of IOL inserted was not reported.</p> <p>Length of follow-up: Planned: not reported Actual: postoperatively at 1, 7, and 30 days; extended to 90 days for SIA</p>
Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined in study reports: uncorrected distance VA, corneal keratometry, and corneal astigmatism and SIA were assessed 1, 7, and 30 days after cataract surgery.</p> <p>Adverse events reported: not reported</p> <p>Intervals at which outcomes assessed: postoperatively at 1, 7, and 30 days; extended to 90 days for SIA</p>
Notes	<p>Full study name: Corneal astigmatism after micro-incision cataract operation</p> <p>Type of study: published</p> <p>Funding sources: not reported</p>

Musanovic 2012 (Continued)

Disclosures of interest: none

Study period: October 2009 to December 2009

Trial registration: not reported

We attempted to contact the authors but did not receive any response.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	High risk	The methods describe 4 outcomes; 2 of them, corneal keratometry and corneal astigmatism, were not found in the results section.
Other bias	Low risk	Source of funding not reported. "Conflict of interest: none declared." (p128)

Shan 2016

Methods

Study design: parallel-group RCT

Number randomized: 362 eyes of 362 participants in total:

211 eyes of 211 participants in C-MICS 2.2-millimeter group

151 eyes of 151 participants in standard phacoemulsification 2.8-millimeter group

Exclusions after randomization: none reported

Number analyzed: 362 eyes of 362 participants in total:

211 eyes of 211 participants in C-MICS 2.2-millimeter group

151 eyes of 151 participants in standard phacoemulsification 2.8-millimeter group

Unit of analysis: 1 eye per participant

Unit of randomization: 1 eye per participant

Losses to follow-up: none reported

How were missing data handled? no missing data reported

Shan 2016 (Continued)

Reported power calculation: none

Participants	<p>Country: China</p> <p>Mean age: not reported</p> <p>Gender: not reported</p> <p>Inclusion criteria: “择 2014-07/2015-03 在宝鸡市人民医院眼 科接受透明角膜切口白内障超声乳化 + 后房型折叠式人 工晶状体植入术的年龄相关性白内障患者 362 例 362 眼 术前矫正视力 0.3 ~ 光感。眼压、光定 位和色觉检查均正常。” (p98)</p> <p>age-related cataract, undertaking clear corneal incision phacoemulsification + implantation of posterior chamber foldable intraocular lens</p> <p>Exclusion criteria: “排除标准: 高度近视、角膜病变、中央角膜内皮细胞臃1800个/mm²、眼底严重病变、青光眼、糖尿病眼底病变、葡萄膜炎、既往眼外伤 或眼手术史患者。” (p98)</p> <p>high myopia, keratopathy, central corneal endothelial cell < 1800/mm², fundus diseases, glaucoma, diabetic retinopathy, uveitis, trauma, previous operation</p>
Interventions	<p>Intervention 1: C-MICS 2.2-millimeter group</p> <p>Intervention 2: standard phacoemulsification 2.8-millimeter group</p> <p>The type of IOL inserted was not reported.</p> <p>Length of follow-up:</p> <p>Planned: not reported</p> <p>Actual: 1 month</p>
Outcomes	<p>Primary outcome, as defined in study reports: uncorrected VA, BCVA, corneal astigmatism, corneal endothelial cell counting, ultrasonic energy, phacoemulsification time</p> <p>Adverse events reported (Y/N): yes, corneal edema</p> <p>Intervals at which outcomes assessed: 1 week and 1 month</p>
Notes	<p>Full study name: 同轴 2.2 mm 与 2.8 mm 切口白内障超声乳化手术疗效 评价</p> <p>[Evaluation on curative effect of coaxial 2.2- and 2.8-millimeter incision phacoemulsification for cataract]</p> <p>Type of study: published full text</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: not reported</p> <p>Study period: July 2014 to March 2015</p> <p>Trial registry number: not reported</p> <p>We attempted to contact the authors but did not receive any response.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported

Shan 2016 (Continued)

Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No missing data reported.
Selective reporting (reporting bias)	Unclear risk	Protocol was not available. Trial registration not reported.
Other bias	Unclear risk	Funding sources, disclosures of interests were not reported.

Shi 2013

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 132 eyes of 98 participants overall: 60 eyes of NR participants in C-MICS (2.2-millimeter incision) group 72 eyes of NR participants in standard phacoemulsification (3.0-millimeter incision) group</p> <p>Exclusions after randomization: none</p> <p>Number analyzed: not reported</p> <p>Unit of analysis: unclear as trial investigators did not report how 34 participants with both eyes included were analyzed</p> <p>Unit of randomization: unclear whether both eyes of the 34 participants were assigned to the same or different groups</p> <p>Losses to follow-up: not reported</p> <p>How were missing data handled? not reported</p> <p>Reported power calculation: no</p> <p>Unusual study design: none</p>
Participants	<p>Country: China</p> <p>Mean age (SD): 72 (NR) overall: 71 (NR) in C-MICS (2.2-millimeter incision) 73 (NR) in standard phacoemulsification (3.0-millimeter incision)</p> <p>Gender: not reported</p> <p>Inclusion criteria: people with cataract with endothelial cell > 2000/mm²</p> <p>Exclusion criteria: people with corneal degeneration, uveitis, or glaucoma</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: C-MICS (2.2-millimeter incision) with AcrySof IQ IOL inserted</p>

Different-sized incisions for phacoemulsification in age-related cataract (Review)

Shi 2013 (Continued)

Intervention 2: standard phacoemulsification (3.0-millimeter incision) with AcrySof Natural IOL inserted

Length of follow-up:

Planned: 3 months

Actual: 3 months

Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined in study reports: average ultrasound power, BCVA, SIA, ECL, incidence of capsule rupture and corneal edema</p> <p>Adverse events reported: yes; posterior capsular rupture and corneal edema</p> <p>Intervals at which outcomes assessed: postoperatively at 1 day, 1 month, and 3 months</p>
Notes	<p>Full study name: Clinical evaluation on the coaxial microincision cataract surgery in hard nuclear cataracts</p> <p>Type of study: published</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: not reported</p> <p>Study period: October 2011 to October 2012</p> <p>Trial registration: NCT01385878 (ClinicalTrials.gov)</p> <p>We attempted to contact the authors but did not receive any response.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	Protocol was not available. Trial registration not reported.
Other bias	Unclear risk	Source of funding and conflicts of interest not reported. The study included both eyes of some participants in the same group, but did not account for in-traperson correlation.

Vasavada 2013a

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 100 eyes of 100 participants in total; 50 eyes of 50 participants per group</p> <p>Exclusions after randomization: not reported</p> <p>Number analyzed: 100 eyes of 100 participants in total; 50 eyes of 50 participants per group</p> <p>Unit of analysis: 1 eye per participant</p> <p>Unit of randomization: 1 eye per participant</p> <p>Losses to follow-up: none</p> <p>How were missing data handled? not reported</p> <p>Reported power calculation: yes: "A sample size of 100 participants was computed ... A difference of 0.175 log units or more was considered ... A sample size of 50 participants in each group would have an 80% power to capture the above-mentioned difference between the 2 groups" (p566-7)</p> <p>Unusual study design: no</p>
Participants	<p>Country: India</p> <p>Mean age (NR): 63.54 (NR) years overall: 64.42 (NR) years in the smaller C-MICS group 62.67 (NR) years in C-MICS (2.2-millimeter incision) group</p> <p>Gender: 50 men (50%) and 50 women (50%) overall: 24 men (48%) and 26 women (52%) in the smaller C-MICS group 26 men (52%) and 24 women (48%) in C-MICS (2.2-millimeter incision) group</p> <p>Inclusion criteria: people with uncomplicated ARC. People having nuclear or corticonuclear cataracts of grade 2 to 4 according to the Lens Opacities Classification System III were included. Ages eligible for study: 50 to 80 years</p> <p>Exclusion criteria: glaucoma, shallow anterior chamber (anterior chamber depth < 2.1 mm), pupil dilation less than 6.0 mm, extremely dense cataract, posterior polar cataract, subluxated cataract, white mature cataract, diabetic retinopathy, high myopia (defined as axial length > 25 mm), uveitis, or previous ocular trauma or surgery</p> <p>Equivalence of baseline characteristics (Y/N): yes</p>
Interventions	<p>Intervention 1: corneal incision system with the Stellaris PC system (Bausch & Lomb) using longitudinal ultrasound (C-MICS 1.8-millimeter incision) with MI60 IOL (Bausch & Lomb) inserted</p> <p>Intervention 2: corneal incision system with the Infiniti Vision system (Alcon) using torsional ultrasound (C-MICS 2.2-millimeter) with AcrySof SN60WF IOL (Alcon) inserted</p> <p>Length of follow-up: Planned: 3 months Actual: 3 months</p>
Outcomes	<p>Primary outcome, as defined in study reports</p> <p>Ingress of trypan blue from the ocular surface into the anterior chamber, SIA at 3 months</p>

Vasavada 2013a (Continued)

Intraoperative outcome measures: total surgical time, CDE, volume of BSS, incision enlargement, trypan blue ingress into the anterior chamber

Postoperative outcome measures: anterior segment optical coherence tomography - incision morphology, localized Descemet membrane detachment (postoperatively at 1 day, 1 week, or 1 month), endothelial gaping or misalignment (postoperative at 1 day and 1 week), epithelial gaps (postoperatively at 1 day and 1 week), anterior segment inflammation (postoperatively at 1 day, 1 week, or 1 month), corneal endothelial morphology (postoperatively at 3 months), CCT (postoperatively at 1 day, 1 week, or 1 month), corneal clarity (postoperatively at 1 day, 1 week, and 1 month)

Secondary outcomes, as defined in study reports: not reported

Adverse events reported: not reported

Intervals at which outcomes assessed: postoperatively at 1 day, 7 days, 1 month, and 3 months

Notes

Full study name: Incision integrity and postoperative outcomes after microcoaxial phacoemulsification performed using 2 incision-dependent systems

Type of study: published

Funding sources: not reported

Disclosures of interest: Iladevi Cataract & IOL Research Centre receives occasional travel support from Alcon Laboratories, Inc. No author has a financial or proprietary interest in any material or method mentioned.

Study period: September 2011 to February 2012

Trial registration: NCT01385878 (ClinicalTrials.gov)

We emailed the authors and included data provided through email correspondence.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	The study mentioned that participants were randomized, but did not specify methods for random sequence generation. We contacted the study investigator, and received the following reply: "Randomization was done using computer generated random numbers."
Allocation concealment (selection bias)	Low risk	From an email correspondence on 24 January 2017: "we prepared sequenced and sealed envelopes containing one of the two options which were stored in a dedicated box in the operating room. An unscrubbed nurse (1 of 2) opened the envelope and informed the operating surgeon of the incision size and phacoemulsification system to be used just prior to beginning of the surgery."
Masking of participants and personnel (performance bias)	Low risk	Both participants and outcome assessors were masked. We contacted the study investigator, and received the following reply: "The patients and outcome assessors were blinded to the technique used, however the surgeon was not. The outcome assessor was another ophthalmologist, and not the operating surgeon."
Masking of outcome assessment (detection bias)	Low risk	"This prospective randomized patient- and analyzer-masked clinical trial comprised participants with uncomplicated age-related cataract"; we contacted the study investigator, and received the following reply: "The patients and outcome assessors were blinded to the technique used, however the surgeon was not. The outcome assessor was another ophthalmologist, and not the operating surgeon."

Vasavada 2013a (Continued)

Incomplete outcome data (attrition bias) All outcomes	Low risk	"No participants were lost to follow-up."
Selective reporting (reporting bias)	Low risk	The study is registered with ClinicalTrials.gov (NCT01385878). The outcomes described in the protocol are consistent with those in the paper.
Other bias	Unclear risk	"Iladevi Cataract & IOL Research Centre receives occasional travel support from Alcon Laboratories, Inc. No author has a financial or proprietary interest in any material or method mentioned." (p563)

Wang 2009

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 83 participants (129 eyes) in total:</p> <p>NR participants (43 eyes) in C-MICS (2.2-millimeter incision) group</p> <p>NR participants (42 eyes) in standard phacoemulsification (2.6-millimeter incision) group</p> <p>NR participants (44 eyes) in standard phacoemulsification (3.0-millimeter incision) group</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: 83 participants (129 eyes) in total:</p> <p>NR participants (43 eyes) in C-MICS (2.2-millimeter incision) group</p> <p>NR participants (42 eyes) in standard phacoemulsification (2.6-millimeter incision) group</p> <p>NR participants (44 eyes) in standard phacoemulsification (3.0-millimeter incision) group</p> <p>Unit of analysis: unclear as trial investigators did not report how 46 participants with both eyes included were analyzed</p> <p>Unit of randomization: unclear whether both eyes of the 46 participants were assigned to the same or different groups</p> <p>Losses to follow-up: none reported</p> <p>How were missing data handled?: no missing data reported</p> <p>Reported power calculation: no</p>
Participants	<p>Country: China</p> <p>Overall mean age: 72 years</p> <p>Mean age (SD): 69 (9) in C-MICS (2.2-millimeter incision) group</p> <p>69 (7) in standard phacoemulsification (2.6-millimeter incision) group</p> <p>71 (8) in standard phacoemulsification (3.0-millimeter incision) group</p> <p>Overall age range: 49 to 83 years</p> <p>Gender: 33 men (40%) and 50 women (60%)</p> <p>Inclusion criteria: people diagnosed with age-related cataract</p> <p>Exclusion criteria: "patients with corneal disease, glaucoma, uveitis, age-related maculopathy, high</p>

Wang 2009 (Continued)

myopia, or history of ocular trauma or surgery were excluded." (p665)

Equivalence of baseline characteristics: yes

Interventions	<p>Intervention 1: C-MICS (2.2-millimeter incision)</p> <p>Intervention 2: standard phacoemulsification (2.6-millimeter incision) (excluded from review)</p> <p>Intervention 3: standard phacoemulsification (3.0-millimeter incision)</p> <p>AcrySof Natural SN60AT IOL (Alcon) was inserted for both groups.</p> <p>Length of follow-up:</p> <p>Planned: protocol not available Actual: 3 months</p>
Outcomes	<p>Outcomes, as defined in study reports: SIA, BCVA, CDE, CCT, anterior chamber depth, ultrasound time</p> <p>Adverse events reported: authors reported no intraoperative complications.</p> <p>Intervals at which outcomes assessed: 1 and 3 months</p>
Notes	<p>Full study name: The effect of micro-incision and small-incision coaxial phaco-emulsification on corneal astigmatism</p> <p>Type of study: published full text</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: not reported</p> <p>Trial registry number: not reported</p> <p>Study period: September 2006 to February 2007</p> <p>We attempted to contact the authors but did not receive any response.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Patients were randomized into three groups: 43 eyes into the 2.2-mm group, 42 eyes into the 2.6-mm group and 44 eyes into the 3.0-mm group." (p665)
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Low risk	"Patients and examiners were masked to the group assignment." (p665)
Masking of outcome assessment (detection bias)	Low risk	"Patients and examiners were masked to the group assignment." (p665)
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No missing data reported.
Selective reporting (reporting bias)	Unclear risk	Protocol is not available. Trial registration not reported.

Wang 2009 (Continued)

Other bias	Unclear risk	Source of funding and conflicts of interest not reported.
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Yao 2008

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 280 eyes total:</p> <p>146 eyes in B-MICS group</p> <p>134 eyes in standard phacoemulsification group</p> <p>Exclusions after randomization: none</p> <p>Number analyzed: 280 eyes total:</p> <p>146 eyes in B-MICS group</p> <p>134 eyes in standard phacoemulsification group</p> <p>Unit of analysis: unclear as number of participants in each group was not reported</p> <p>Unit of randomization: unclear as number of participants in each group was not reported</p> <p>Losses to follow-up: not reported</p> <p>How were missing data handled? not reported</p> <p>Reported power calculation: no</p> <p>Unusual study design: no</p>
Participants	<p>Country: China</p> <p>Mean age : 69 years overall:</p> <p>69 years in B-MICS group</p> <p>69 years in standard phacoemulsification group</p> <p>Age range: 51 to 86 years</p> <p>Gender: 126 men (45%) and 154 women (55%) overall:</p> <p>64 men (44%) and 82 women (56%) in B-MICS group</p> <p>62 men (46%) and 72 women (54%) in standard phacoemulsification group</p> <p>Inclusion criteria: not reported</p> <p>Exclusion criteria: people with corneal diseases, glaucoma, and uveitis or surgery history of eye were excluded.</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: B-MICS (1.5-millimeter incision) group with Acri.Smart46s (Acti.Tec) IOL inserted</p> <p>Intervention 2: standard phacoemulsification (3.0-millimeter incision) group with Staar KS-1 (Canon) IOL inserted</p> <p>We considered standard phacoemulsification with incisions ranging from 2.75 to 3.2 mm to be about 3.0 mm.</p> <p>Length of follow-up:</p>

Yao 2008 (Continued)

Planned: 3 months

Actual: 3 months

Outcomes	<p>Primary outcome, as defined in study reports: phacoemulsification time, VA, CCT, ECL, SIA</p> <p>Secondary outcomes, as defined in study reports: not reported</p> <p>Adverse events reported: no</p> <p>Intervals at which outcomes assessed: postoperatively at 1 day and 3 months</p>
Notes	<p>Full study name: Clinical evaluation on the bimanual microincision cataract surgery</p> <p>Type of study: published</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: not reported</p> <p>Study period: January 2006 to May 2007</p> <p>Trial registration: not reported</p> <p>Data were clarified by an author of this review.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"The study used 'random numbers table' for sequence generation"
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Low risk	"Participants were masked to their treatment groups"
Masking of outcome assessment (detection bias)	Low risk	"Outcome assessors were masked to their treatment groups"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	Protocol is not available. Trial registration not reported.
Other bias	Unclear risk	Source of funding and conflicts of interest not reported.

Yao 2011

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 89 eyes of 89 participants in total:</p> <p>45 eyes of 44 participants in the smaller C-MICS group</p>
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Yao 2011 (Continued)

44 eyes of 44 participants in standard phacoemulsification (3.0-millimeter incision) group

Exclusions after randomization: 1 eye of 1 participant in microincision cataract surgery (1.8-millimeter incision) group

Number analyzed: 80 eyes of 80 participants total; 40 eyes in each group

Unit of analysis: 1 eye per participant

Unit of randomization: 1 eye per participant

Losses to follow-up: 9 participants

How were missing data handled? not reported

Reported power calculation: no

Unusual study design: no

Participants	<p>Country: China</p> <p>Mean age: 72 years overall; number not reported by group</p> <p>Gender: 29/80 men (36%) and 51/80 women (64%) overall; number not reported by group</p> <p>Inclusion criteria: ARC with astigmatism < 2.00 diopters</p> <p>Exclusion criteria: people with corneal diseases, uveitis, glaucoma, age-related macular degeneration, high myopia, eye trauma, or surgery history of eyes were excluded.</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: smaller C-MICS with Akreos MI 60 IOL inserted</p> <p>Intervention 2: standard phacoemulsification (3.0-millimeter incision) with Akreos Adapt IOL inserted</p> <p>Length of follow-up:</p> <p>Planned: 3 months Actual: 3 months</p>
Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined in study reports: average ultrasound power, effective phacoemulsification time, uncorrected VA, BCVA, ECL, SIA</p> <p>Adverse events reported: no</p> <p>Intervals at which outcomes assessed: postoperatively at 1 day, 1 week, 1 month, and 3 months</p>
Notes	<p>Full study name: Clinical evaluation on the coaxial 1.8 mm microincision cataract surgery</p> <p>Type of study: published</p> <p>Funding sources: National Eleventh Five-Year Technology Support Program (2006BAI02B04), Zhejiang Key Creative Group of Technology (2009R50039)</p> <p>Disclosures of interest: not reported</p> <p>Study period: July 2009 to May 2010</p> <p>Trial registration: not reported</p> <p>Data were clarified by an author of this review.</p>

Risk of bias

Yao 2011 (Continued)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"The study used random numbers table for sequence generation"
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Low risk	"Participants were masked to their treatment groups"
Masking of outcome assessment (detection bias)	Low risk	"Outcome assessors were masked to their treatment groups"
Incomplete outcome data (attrition bias) All outcomes	Low risk	9 out of 89 participants (10%) lost to follow-up, but reasons not reported. 4 cases dropped out at 1 month, 5 extra cases dropped out at 3 months.
Selective reporting (reporting bias)	Unclear risk	Protocol is not available. Trial registration not reported.
Other bias	Unclear risk	Source of funding and conflicts of interest not reported.

Yu 2016

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 150 eyes of 150 participants in total; 50 eyes of 50 participants in each group</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: not reported, assumed to be 150 eyes of 150 participants in total; 50 eyes of 50 participants in each group</p> <p>Unit of analysis: 1 eye per participant</p> <p>Unit of randomization: 1 eye per participant</p> <p>Losses to follow-up: none reported</p> <p>How were missing data handled? no missing data reported</p> <p>Reported power calculation: no</p>
Participants	<p>Country: China</p> <p>Mean age (SD) : 70.44 (NR) overall:</p> <p>70.30 (6.67) in the smaller C-MICS group</p> <p>70.68 (6.98) in microincision (2.0-millimeter) group</p> <p>70.34 (7.23) in standard phacoemulsification group</p> <p>Gender: not reported</p> <p>Inclusion criteria: "ages between 50 and 80y, with no medication history or other eye disease." (p400)</p> <p>Exclusion criteria: "diabetes or other diseases which may influence the biomechanical properties of the cornea were also excluded" (p400)</p> <p>Equivalence of baseline characteristics: yes</p>

Yu 2016 (Continued)

Interventions	<p>Intervention 1: smaller C-MICS group with Akreos MI 60 IOL (Bausch & Lomb) inserted</p> <p>Intervention 2: microincision (2.0 mm) (excluded from review)</p> <p>Intervention 3: standard phacoemulsification (3.0-millimeter incision) group with PY-60 IOL implantation (Hoya, Japan) inserted</p> <p>Length of follow-up: Planned: not reported Actual: 3 months</p>
Outcomes	<p>Outcomes, as defined in study reports: intraoperative data and postoperative outcomes including SIA, corneal incision thickness, wavefront aberrations and modulation transfer function of cornea were obtained.</p> <p>Adverse events reported: not reported</p>
Notes	<p>Full study name: A comparable study of clinical and optical outcomes after 1.8, 2.0 mm microcoaxial and 3.0 mm coaxial cataract surgery</p> <p>Type of study: published full text</p> <p>Funding sources: supported by the Key Program of the National Natural Science Foundation of China (No. 81130018); National Twelfth Five-Year Plan Foundation of China (No. 2012BAI08B01); Zhejiang Key Innovation Team Project of China (No. 2009R50039); Zhejiang Key Laboratory Fund of China (No. 2011E10006)</p> <p>Disclosures of interest: "none" (p404)</p> <p>Trial registry number: ChiCTR-TRC-12002565</p> <p>Study period: not reported</p> <p>Data were clarified by an author of this review.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	"The postoperative follow-up was performed by the same independent examiner, who did not perform any of the surgeries."
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Loss to follow-up was not reported.
Selective reporting (reporting bias)	Low risk	All prespecified outcomes in the trial registry were reported.
Other bias	Low risk	Reported no conflict of interest and government-funded trial

Zhang 2014

Methods	<p>Study design: parallel-group RCT</p> <p>Number randomized: 160 participants with 168 eyes in total:</p> <p>84 eyes of 80 participants in the smaller C-MICS group</p> <p>84 eyes of 83 participants in the standard phacoemulsification group</p> <p>Exclusions after randomization: none reported</p> <p>Number analyzed: not reported, assumed to be 160 participants with 168 eyes in total:</p> <p>84 eyes of 80 participants in the smaller C-MICS group</p> <p>84 eyes of 83 participants in the standard phacoemulsification group</p> <p>Unit of analysis: unclear as trial investigators did not report how 8 participants with both eyes included were analyzed</p> <p>Unit of randomization: unclear whether both eyes of the 8 participants were assigned to the same or different groups</p> <p>Losses to follow-up: none reported</p> <p>How were missing data handled? no missing data reported</p> <p>Reported power calculation: no</p> <p>Unusual study design: none</p>
Participants	<p>Country: China</p> <p>Mean age : 68.5 overall:</p> <p>67.5 in the smaller C-MICS group</p> <p>69.8 in the standard phacoemulsification group</p> <p>Age range: 50 to 83 years overall:</p> <p>50 to 83 years in the smaller C-MICS group</p> <p>52 to 81 years in the standard phacoemulsification group</p> <p>Gender: 83 women and 77 men overall:</p> <p>45 women and 35 men in the smaller C-MICS group</p> <p>38 women and 42 men in the standard phacoemulsification group</p> <p>Inclusion criteria: “age-related cataract, lens nucleus hardness LOCS level 2-5” (p671)</p> <p>Exclusion criteria: “history of eye trauma, corneal scar, glaucoma, diabetic retinopathy, macular degeneration” (p671)</p> <p>Equivalence of baseline characteristics: yes</p>
Interventions	<p>Intervention 1: smaller C-MICS group with ZEISS ASPHINA 509M IOL inserted</p> <p>Intervention 2: standard phacoemulsification with 3.2-millimeter incision group with ZEISS SPHERIS 209M IOL inserted</p> <p>Length of follow-up:</p> <p>Planned: protocol not available</p> <p>Actual: 1 day, 1 week, and 1 month</p>
Outcomes	<p>Outcomes, as defined in study reports: postoperative astigmatism, uncorrected VA</p> <p>Secondary outcomes, as defined in study reports: none</p> <p>Adverse events reported: not reported</p> <p>Intervals at which outcomes assessed: 1 day, 1 week, 1 month</p>

Zhang 2014 (Continued)

Notes

Full study name: Effect of 1.8 coaxial micro-incision cataract phacoemulsification on corneal astigmatism

Type of study: published full text

Funding sources: not reported

Disclosures of interest: not reported

Trial registry number: not reported

Study period: January 2012 to June 2012

We attempted to contact the authors but did not receive any response.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	Protocol is not available. Trial registration not reported.
Other bias	Unclear risk	Source of funding and conflicts of interest not reported.

Zhu 2014

Methods

Study design: paired-eye RCT

Number randomized: 90 eyes of 45 participants in total; 45 eyes of 45 participants in each group

Exclusions after randomization: none reported

Number analyzed: 90 eyes of 45 participants in total; 45 eyes of 45 participants in each group

Unit of analysis: 1 eye per participant

Unit of randomization: 1 eye per participant

Losses to follow-up: none reported

How were missing data handled? no missing data reported

Reported power calculation: no

Unusual study design: the study randomized participants and included both eyes of the same participant in the same intervention, but they did not account for intraperson correlation.

Participants

Country: China

Zhu 2014 (Continued)

Mean age : 67.7 overall:

66.8 years in the larger C-MICS group

68.4 years in the standard phacoemulsification 3.0-millimeter group

Age range: 39 to 83 years overall:

39 to 80 years in the larger C-MICS group

48 to 83 years in the standard phacoemulsification 3.0-millimeter group

Gender: 24 men (53%) and 21 women (47%) in total and by group

Inclusion criteria: "patients with age-related cataract undertaking phacoemulsification and intraocular lens implantation" (p1434)

Exclusion criteria: none reported

Equivalence of baseline characteristics: yes

Interventions	<p>Intervention 1: larger C-MICS</p> <p>Intervention 2: standard phacoemulsification with 3.0-millimeter incision</p> <p>The type of IOL inserted was not reported.</p> <p>Length of follow-up:</p> <p>Planned: not reported Actual: 3 months</p>
Outcomes	<p>Primary and secondary outcomes not differentiated.</p> <p>Outcomes, as defined in study reports: VA, corneal endothelial cell counting, CCT, SIA</p> <p>Intervals at which outcomes assessed: 1 day, 1 week, 1 month, 3 months</p>
Notes	<p>Full study name: 不同切口同轴白内障超声乳化术的疗效比较</p> <p>[Comparison of 2.2-millimeter microincision and 3.0-millimeter incision coaxial phacoemulsification]</p> <p>Type of study: published full text</p> <p>Funding sources: not reported</p> <p>Disclosures of interest: not reported</p> <p>Trial registry number: not reported</p> <p>Study period: January 2012 to June 2013</p> <p>We attempted to contact the authors but did not receive any response.</p>
Risk of bias	
Bias	Authors' judgement Support for judgement
Random sequence generation (selection bias)	Unclear risk Not reported
Allocation concealment (selection bias)	Unclear risk Not reported

Zhu 2014 (Continued)

Masking of participants and personnel (performance bias)	Unclear risk	Not reported
Masking of outcome assessment (detection bias)	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Losses to follow-up or missing data were not reported.
Selective reporting (reporting bias)	Unclear risk	Protocol not reported. Trial registration not reported.
Other bias	Unclear risk	Funding sources and disclosure of interest not reported.

ARC: age-related cataract
 AS-OCT: anterior segment optical coherence tomography
 B-MICS: biaxial microincision cataract surgery
 BCVA: best-corrected visual acuity
 BSS: balanced salt solution
 C-MICS: coaxial microincision cataract surgery
 CCT: central corneal thickness
 CDE: cumulative dissipated energy
 ECL: endothelial cell loss
 IL-1alpha: interleukin 1 alpha
 IL6: interleukin 6
 IOP: intraocular lens
 LOCS: Lens Opacities Classification System
 NR: not reported
 PGE2: prostaglandin E2
 RCT: randomized controlled trial
 SD: standard deviation
 SIA: surgically induced astigmatism
 UST: ultrasound time
 VA: visual acuity
 VEGF: vascular endothelial growth factor

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Alio 2005	RCT, but included the wrong intervention as the B-MICS group's final incision size was 1.7 ± 0.21 mm, which overlapped with 2 of our comparison groups
Alio 2010	RCT, but included the wrong intervention as B-MICS group's final incision size range was from 1.6 to 1.8 mm, which overlapped with 2 of our comparison groups
Bhargava 2016	RCT, but included the wrong intervention as the authors compared phacoemulsification versus manual small-incision cataract surgery without phacoemulsification, removing cataract mechanically
Can 2011	Not an RCT; this was a cohort study, and wrong intervention as incisions were enlarged before IOL implantation

Study	Reason for exclusion
Can 2012	RCT, but wrong intervention as incisions were enlarged before IOL implantation. The incision made for phacoemulsification procedure was not large enough for the IOL implantation, therefore the incision was enlarged, and the final incision size overlapped with our comparison groups.
Cavallini 2007	RCT, but wrong intervention as incisions were enlarged before IOL implantation. The incision made for phacoemulsification procedure was not large enough for the IOL implantation, therefore the incision was enlarged, and the final size overlapped with our comparison groups.
Chee 2010	RCT, but wrong intervention as the incisions in standard phacoemulsification group were 2.65 mm, not in the range of 2.75 to 3.2 mm
Crema 2007	RCT, but wrong intervention as the incisions in B-MICS group were enlarged to 2.8 mm before IOL implantation. The incision made for phacoemulsification procedure was not large enough for the IOL implantation, therefore the incision was enlarged, and the final incision size overlapped with our comparison groups.
Denoyer 2008	RCT, but wrong intervention as the incisions in B-MICS group were 1.7 mm
Devendra 2014	RCT, but wrong intervention as 2.8-millimeter incision was enlarged to 5.2 mm at the end of surgery
Dick 2012	RCT, but wrong participants as incisions were enlarged in B-MICS group to 1.8 mm before IOL implantation. The final incision size overlapped with the smaller C-MICS group.
Elkady 2009	RCT, but wrong intervention as incisions were enlarged before IOL implantation. The incision made for phacoemulsification procedure was not large enough for the IOL implantation, therefore the incision was enlarged, and the final incision size overlapped with our comparison groups.
Feng 2015	RCT, but wrong intervention as incisions were enlarged before IOL implantation. The incision made for phacoemulsification procedure was not large enough for the IOL implantation, therefore the incision was enlarged, and the final incision size overlapped with our comparison groups.
Franchini 2006	RCT, but wrong intervention as single stitch was made in all participants, which affected the surgically induced astigmatism
Gangwani 2011	RCT, but wrong comparison as both intervention groups used the same incision size
Hashemian 2007	RCT, but the conference abstract did not report the incision sizes created during microcoaxial and conventional phacoemulsification. Author contact information was not available through the conference website or other publications in PubMed.
Hayashi 2014	RCT, but wrong comparison as the final incision size for the standard phacoemulsification group was 2.65 mm, which was not within our range of 2.75 mm to 3.2 mm
Hayashi 2016	RCT, but wrong comparison as both intervention groups used the same incision size
Jain 2015	RCT, but wrong intervention as incision was performed at the steep axis, which affects the evaluation of surgically induced astigmatism
Jeon 2010	RCT, but wrong intervention as the incision size in the standard phacoemulsification group was 4.0 mm, which was not within our range of 2.75 mm to 3.2 mm
Jiang 2005	RCT, but wrong intervention as incision was enlarged to 2.0 mm or 3.0 mm for IOL implant
Kahraman 2007	This was a case series, not an RCT, and wrong intervention as the incision for the B-MICS (1.4-millimeter) group was enlarged to 3.2 mm before IOL implantation. The incision made for phacoemul-

Study	Reason for exclusion
	sification procedure was not large enough for the IOL implantation, therefore the incision size was enlarged, and the size overlapped with our comparison groups.
Kaya 2007	RCT, but wrong intervention as the incisions in B-MICS group were enlarged to 2.0 mm for IOL implantation
Kim 2011	RCT, but wrong comparison as the study authors compared pulse, burst, and continuous phacoemulsification mode
Kim 2013	RCT, but wrong comparison as the intervention involved suturing the corneal incision, which affected the evaluation of surgically induced astigmatism
Kochhar 2014	RCT, but wrong comparison as intervention was manual small-incision cataract extraction without phacoemulsification
Kurz 2006	RCT, but wrong intervention as the incision size was enlarged from 1.5 mm to 1.7 mm during IOL insertion
Kurz 2009	RCT, but wrong intervention as the incision was enlarged from 1.5 mm to 1.7 mm in the B-MICS group before IOL implantation. The incision made for phacoemulsification procedure was not large enough for the IOL implantation, therefore the incision was enlarged, and the final incision was larger than 1.5 mm.
Lee 2009	RCT, but wrong population as the participants "had nuclear or corticonuclear cataract of grade II to IV according to the Lens Opacities Classification System III (LOCS III) scale" (p875)
Masket 2009	Not an RCT; quasi-RCT as "patients were randomized by date of surgery; on odd dates, patients received a 3-mm incision and on even dates a 2.2-mm incision was used for the first eye." (p22)
Mencucci 2006	RCT, but wrong intervention as both incisions enlarged to 2.75 mm before IOL implantation. The incision made for phacoemulsification procedure was not large enough for the IOL implantation, therefore the incision was enlarged, and the final incision size overlapped with our comparison groups.
NCT02642211	RCT, but wrong comparison as the intervention was manual small-incision cataract surgery
Park 2012	Not an RCT; study did not report how participants were allocated to treatment groups. However, it was described as a "prospective, observer-masked study" (p56).
Shen 2014	RCT, but wrong intervention as the study compared 2.5-millimeter (out the range of 2.75- to 3.2-millimeter) mini-incision coaxial phacoemulsification with 1.8-millimeter microincision cataract surgery
Song 2014	RCT, but wrong comparison as the intervention was manual small-incision cataract extraction without phacoemulsification; the cataract was removed using irrigating vectis
Suasnavas 2010	Not an RCT; this was a case series of people with nuclear or corticonuclear cataracts
Titiyal 2006	RCT, but the incision size was not reported and the authors could be not be reached
Tong 2008	RCT, but wrong intervention as incision size was enlarged before IOL implantation. The incision made for phacoemulsification procedure was not large enough for the IOL implantation, therefore the incision was enlarged, and the final incision size overlapped with our comparison groups.
Vasavada 2013b	Animal study (rabbit eyes)
von Sonnleithner 2015	RCT, but wrong comparison as participants were assigned to different IOL groups

Study	Reason for exclusion
Wang 2012	RCT, but wrong intervention as incisions were enlarged before IOL implantation. The incision made for phacoemulsification procedure was not large enough for the IOL implantation, therefore the incision was enlarged, and the final incision size overlapped with our comparison groups.
Wei 2012	RCT, but wrong comparison as the incisions were enlarged to 3.5 mm before IOL implantation. The incision made for phacoemulsification procedure was not large enough for the IOL implantation, therefore the incision size was enlarged, and the final incision size overlapped with our comparison groups.
Wilczynska 2010	Authors did not report how participants were assigned to treatment groups, and wrong intervention compared (B-MICS incision size was 1.7 mm).
Wylegala 2009	RCT, but we attempted to contact the authors as it was unclear if the incision had been enlarged
Yao 2006	RCT, but wrong comparison as the B-MICS incision size was 1.7 mm
Zhou 2012	RCT, but wrong intervention as the surgery was performed on the steepest corneal meridians, which affects the evaluation of surgically induced astigmatism by usually decreasing the astigmatism

ARC: age-related cataract

B-MICS: biaxial microincision cataract surgery

C-MICS: coaxial microincision cataract surgery

CCT: controlled clinical trial

IOL: intraocular lens

RCT: randomized controlled trial

DATA AND ANALYSES

Comparison 1. Larger coaxial microincision cataract surgery versus standard phacoemulsification

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mean postoperative surgically induced astigmatism at 3 months	8	996	Mean Difference (IV, Random, 95% CI)	-0.19 [-0.30, -0.09]
2 Mean postoperative best-corrected visual acuity at 3 months	3	242	Mean Difference (IV, Random, 95% CI)	0.00 [-0.02, 0.02]
3 Mean change of endothelial cell loss at 3 months	4	596	Mean Difference (IV, Random, 95% CI)	-7.23 [-78.66, 64.20]
4 Mean change of central corneal thickness at 3 months	5	487	Mean Difference (IV, Random, 95% CI)	-0.68 [-3.26, 1.90]
5 Intraoperative use of cumulative dissipated energy	6	784	Mean Difference (IV, Random, 95% CI)	-0.30 [-1.33, 0.72]
6 Intraoperative use of balanced salt solution	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
7 Surgical time	3	314	Mean Difference (IV, Fixed, 95% CI)	-0.05 [-0.26, 0.16]
8 Phacoemulsification time	4	608	Mean Difference (IV, Random, 95% CI)	-0.96 [-3.48, 1.56]
9 Corneal edema	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

Analysis 1.1. Comparison 1 Larger coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 1 Mean postoperative surgically induced astigmatism at 3 months.

Analysis 1.2. Comparison 1 Larger coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 2 Mean postoperative best-corrected visual acuity at 3 months.

Analysis 1.3. Comparison 1 Larger coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 3 Mean change of endothelial cell loss at 3 months.

Analysis 1.4. Comparison 1 Larger coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 4 Mean change of central corneal thickness at 3 months.

Analysis 1.5. Comparison 1 Larger coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 5 Intraoperative use of cumulative dissipated energy.

Analysis 1.6. Comparison 1 Larger coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 6 Intraoperative use of balanced salt solution.

Study or subgroup	Larger C-MICS		Standard		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Fixed, 95% CI	Fixed, 95% CI
Luo 2012	40	39.1 (13.9)	40	36.2 (9.1)		2.87[-2.26,8]
					Favors larger C-MICS	Favors standard

Analysis 1.7. Comparison 1 Larger coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 7 Surgical time.

Study or subgroup	Larger C-MICS		Standard		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Fixed, 95% CI		Fixed, 95% CI
Can 2010	45	13 (3.7)	45	14.5 (4.2)		1.64%	-1.47[-3.1,0.16]
Jeong 2013	72	8.3 (1.4)	72	8.2 (1.2)		25.39%	0.13[-0.28,0.54]
Luo 2012	40	6.5 (0.6)	40	6.5 (0.5)		72.97%	-0.08[-0.32,0.16]
Total ***	157		157			100%	-0.05[-0.26,0.16]
Heterogeneity: Tau ² =0; Chi ² =3.7, df=2(P=0.16); I ² =45.92%							
Test for overall effect: Z=0.46(P=0.64)							
					Favors larger C-MICS		Favors standard

Analysis 1.8. Comparison 1 Larger coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 8 Phacoemulsification time.

Study or subgroup	Larger C-MICS		Standard		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Random, 95% CI		Random, 95% CI
Can 2010	45	12 (7.8)	45	16.2 (11.4)		22%	-4.2[-8.24,-0.16]
Li 2011	37	19.6 (4.5)	39	20.6 (5.5)		36.04%	-1.04[-3.28,1.2]
Luo 2012	40	45.5 (22.4)	40	48.5 (20.1)		6.38%	-3.01[-12.34,6.32]
Shan 2016	211	27.8 (10.6)	151	26.3 (11.2)		35.58%	1.5[-0.79,3.79]
Total ***	333		275			100%	-0.96[-3.48,1.56]
Heterogeneity: Tau ² =3.28; Chi ² =6.65, df=3(P=0.08); I ² =54.86%							
Test for overall effect: Z=0.74(P=0.46)							
					Favors larger C-MICS		Favors standard

Analysis 1.9. Comparison 1 Larger coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 9 Corneal edema.

Study or subgroup	Larger C-MICS	Standard	Risk Ratio		Risk Ratio			
	n/N	n/N	M-H, Fixed, 95% CI		M-H, Fixed, 95% CI			
Shan 2016	10/211	7/151			1.02[0.4,2.63]			
		Favors larger C-MICS	0.5	0.7	1	1.5	2	Favors standard

Comparison 2. Smaller coaxial microincision cataract surgery versus standard phacoemulsification

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mean postoperative surgically induced astigmatism at 3 months	5	561	Mean Difference (IV, Random, 95% CI)	-0.23 [-0.34, -0.13]
2 Mean postoperative best-corrected visual acuity at 3 months	3	192	Mean Difference (IV, Fixed, 95% CI)	-0.02 [-0.03, -0.00]
3 Mean change of endothelial cell loss at 3 months	5	380	Mean Difference (IV, Random, 95% CI)	7.56 [-67.65, 82.77]
4 Mean change of central corneal thickness at 3 months	3	245	Mean Difference (IV, Fixed, 95% CI)	-1.52 [-6.29, 3.25]
5 Intraoperative use of cumulative dissipated energy	2	360	Mean Difference (IV, Fixed, 95% CI)	-4.25 [-5.43, -3.07]
6 Intraoperative use of balanced salt solution	2	130	Mean Difference (IV, Fixed, 95% CI)	-1.93 [-6.32, 2.46]
7 Surgical time	2	130	Mean Difference (IV, Fixed, 95% CI)	-0.14 [-0.35, 0.07]
8 Phacoemulsification time	2	130	Mean Difference (IV, Fixed, 95% CI)	8.20 [2.88, 13.52]

Analysis 2.1. Comparison 2 Smaller coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 1 Mean postoperative surgically induced astigmatism at 3 months.

Analysis 2.2. Comparison 2 Smaller coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 2 Mean postoperative best-corrected visual acuity at 3 months.

Analysis 2.3. Comparison 2 Smaller coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 3 Mean change of endothelial cell loss at 3 months.

Analysis 2.4. Comparison 2 Smaller coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 4 Mean change of central corneal thickness at 3 months.

Analysis 2.5. Comparison 2 Smaller coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 5 Intraoperative use of cumulative dissipated energy.

Analysis 2.6. Comparison 2 Smaller coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 6 Intraoperative use of balanced salt solution.

Analysis 2.7. Comparison 2 Smaller coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 7 Surgical time.

Analysis 2.8. Comparison 2 Smaller coaxial microincision cataract surgery versus standard phacoemulsification, Outcome 8 Phacoemulsification time.

Comparison 3. Smaller versus larger coaxial microincision cataract surgery

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mean postoperative surgically induced astigmatism at 3 months	3	259	Mean Difference (IV, Fixed, 95% CI)	0.04 [-0.09, 0.16]
2 Mean postoperative best-corrected visual acuity at 3 months	3	200	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.01, 0.04]
3 Mean endothelial cell loss at 3 months	1	70	Mean Difference (IV, Fixed, 95% CI)	213.00 [11.15, 414.85]
4 Mean change of central corneal thickness at 3 months	1	100	Mean Difference (IV, Fixed, 95% CI)	0.45 [-2.70, 3.60]
5 Intraoperative use of cumulative dissipated energy	4	300	Mean Difference (IV, Random, 95% CI)	-0.33 [-3.72, 3.07]
6 Intraoperative use of balanced salt solution	3	210	Mean Difference (IV, Fixed, 95% CI)	1.04 [-2.45, 4.53]
7 Surgical time	2	180	Mean Difference (IV, Fixed, 95% CI)	0.33 [0.12, 0.55]
8 Phacoemulsification time	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

Analysis 3.1. Comparison 3 Smaller versus larger coaxial microincision cataract surgery, Outcome 1 Mean postoperative surgically induced astigmatism at 3 months.

Analysis 3.2. Comparison 3 Smaller versus larger coaxial microincision cataract surgery, Outcome 2 Mean postoperative best-corrected visual acuity at 3 months.

Analysis 3.3. Comparison 3 Smaller versus larger coaxial microincision cataract surgery, Outcome 3 Mean endothelial cell loss at 3 months.

Analysis 3.4. Comparison 3 Smaller versus larger coaxial microincision cataract surgery, Outcome 4 Mean change of central corneal thickness at 3 months.

Analysis 3.5. Comparison 3 Smaller versus larger coaxial microincision cataract surgery, Outcome 5 Intraoperative use of cumulative dissipated energy.

Analysis 3.6. Comparison 3 Smaller versus larger coaxial microincision cataract surgery, Outcome 6 Intraoperative use of balanced salt solution.

Analysis 3.7. Comparison 3 Smaller versus larger coaxial microincision cataract surgery, Outcome 7 Surgical time.

Analysis 3.8. Comparison 3 Smaller versus larger coaxial microincision cataract surgery, Outcome 8 Phacoemulsification time.

Comparison 4. Biaxial microincision cataract surgery versus standard phacoemulsification

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mean postoperative surgically induced astigmatism at 3 months	2	368	Mean Difference (IV, Fixed, 95% CI)	-0.01 [-0.03, 0.01]
2 Mean postoperative surgically induced astigmatism at 6 months	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3 Mean postoperative best-corrected visual acuity at 3 months	3	464	Mean Difference (IV, Fixed, 95% CI)	-0.02 [-0.04, -0.00]
4 Mean endothelial cell loss at 3 months	1	280	Mean Difference (IV, Fixed, 95% CI)	55.83 [-34.93, 146.59]
5 Postoperative central corneal thickness at 3 months	1	90	Mean Difference (IV, Fixed, 95% CI)	0.10 [-14.04, 14.24]
6 Intraoperative use of cumulative dissipated energy	2	370	Mean Difference (IV, Fixed, 95% CI)	-5.27 [-6.58, -3.97]
7 Surgical time	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
8 Phacoemulsification time	2	370	Mean Difference (IV, Fixed, 95% CI)	-5.58 [-9.52, -1.63]

Analysis 4.1. Comparison 4 Biaxial microincision cataract surgery versus standard phacoemulsification, Outcome 1 Mean postoperative surgically induced astigmatism at 3 months.

Analysis 4.2. Comparison 4 Biaxial microincision cataract surgery versus standard phacoemulsification, Outcome 2 Mean postoperative surgically induced astigmatism at 6 months.

Analysis 4.3. Comparison 4 Biaxial microincision cataract surgery versus standard phacoemulsification, Outcome 3 Mean postoperative best-corrected visual acuity at 3 months.

Analysis 4.4. Comparison 4 Biaxial microincision cataract surgery versus standard phacoemulsification, Outcome 4 Mean endothelial cell loss at 3 months.

Analysis 4.5. Comparison 4 Biaxial microincision cataract surgery versus standard phacoemulsification, Outcome 5 Postoperative central corneal thickness at 3 months.

Analysis 4.6. Comparison 4 Biaxial microincision cataract surgery versus standard phacoemulsification, Outcome 6 Intraoperative use of cumulative dissipated energy.

Analysis 4.7. Comparison 4 Biaxial microincision cataract surgery versus standard phacoemulsification, Outcome 7 Surgical time.

Analysis 4.8. Comparison 4 Biaxial microincision cataract surgery versus standard phacoemulsification, Outcome 8 Phacoemulsification time.

APPENDICES

Appendix 1. CENTRAL search strategy

- #1 MeSH descriptor Cataract explode all trees
- #2 MeSH descriptor Cataract Extraction explode all trees
- #3 MeSH descriptor Phacoemulsification explode all trees
- #4 MeSH descriptor Capsulorhexis explode all trees
- #5 (Cataract* near/4 (extract* OR aspirat* OR operat* OR remov* OR surg* OR excis* OR implant*))
- #6 (lens* near/4 (extract* OR aspirat* OR operat* OR remov* OR surg* OR excis* OR implant* OR emulsif*))
- #7 (Cataract Extraction* OR Phakectomy* OR Zonulolysis* OR cataractomy*)
- #8 (pha*oemulsif* OR pha?o OR Capsulor*hexis OR lensectom*)
- #9 Microphaco* OR miniphaco*
- #10 Coaxial OR co-axial OR biaxial OR bimanual OR Microcoaxial OR micro-coaxial OR MICS OR C-MICS OR B-MICS OR MISICS OR SICS
- #11 (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10)
- #12 Incision* OR microincision*
- #13 MeSH descriptor Microsurgery, this term only with qualifier: MT
- #14 MeSH descriptor Surgical Procedures, Minimally Invasive, this term only
- #15 (#12 OR #13 OR #14)
- #16 (#11 AND #15)

Appendix 2. MEDLINE Ovid search strategy

1. Randomized Controlled Trial.pt.
2. Controlled Clinical Trial.pt.
3. (randomized or randomised).ab,ti.
4. placebo.ab,ti.
5. drug therapy.fs.
6. randomly.ab,ti.
7. trial.ab,ti.
8. groups.ab,ti.
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. exp animals/ not humans.sh.
11. 9 not 10
12. exp Cataract/
13. exp cataract extraction/
14. exp Phacoemulsification/
15. exp Capsulorhexis/
16. (Cataract* adj4 (extract* or aspirat* or operat* or remov* or surg* or excis* or implant*)).tw.
17. (lens* adj4 (extract* or aspirat* or operat* or remov* or surg* or excis* or implant* or emulsif*)).tw.
18. (Phakectom* or Zonulolys* or cataractom*).tw.
19. (pha*oemulsif* or pha?o or Capsulor*hexis or lensectom*).tw.
20. (Microphaco* or micro-phaco or miniphaco* or mini-phaco*).tw.
21. (Coaxial or co-axial or biaxial or bimanual or Microcoaxial or micro-coaxial).tw.
22. (C-MICS or B-MICS or MISICS or SICS or MICS).tw.
23. 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22
24. (Incision* or microincision*).tw.
25. Microsurgery/mt [Methods]
26. Surgical Procedures, Minimally Invasive/
27. 24 or 25 or 26
28. 11 and 23 and 27

The search filter for trials at the beginning of the MEDLINE strategy is from the published paper by [Glanville 2006](#).

Appendix 3. Embase.com search strategy

- #1 'randomized controlled trial'/exp
- #2 'randomization'/exp
- #3 'double blind procedure'/exp
- #4 'single blind procedure'/exp
- #5 random*:ab,ti
- #6 #1 OR #2 OR #3 OR #4 OR #5
- #7 'animal'/exp OR 'animal experiment'/exp
- #8 'human'/exp
- #9 #7 AND #8
- #10 #7 NOT #9
- #11 #6 NOT #10
- #12 'clinical trial'/exp
- #13 (clin* NEAR/3 trial*):ab,ti
- #14 ((singl* OR doubl* OR trebl* OR tripl*) NEAR/3 (blind* OR mask*)):ab,ti
- #15 'placebo'/exp
- #16 placebo*:ab,ti
- #17 random*:ab,ti
- #18 'experimental design'/exp
- #19 'crossover procedure'/exp
- #20 'control group'/exp
- #21 'latin square design'/exp
- #22 #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21
- #23 #22 NOT #10
- #24 #23 NOT #11
- #25 'comparative study'/exp
- #26 'evaluation'/exp
- #27 'prospective study'/exp
- #28 control*:ab,ti OR prospectiv*:ab,ti OR volunteer*:ab,ti

```
#29 #25 OR #26 OR #27 OR #28
#30 #29 NOT #10
#31 #30 NOT (#11 OR #23)
#32 #11 OR #24 OR #31
#33 'cataract'/exp
#34 (cataract* NEAR/4 (extract* OR aspirat* OR operat* OR remov* OR surg* OR excis* OR implant*)) :ab,ti
#35 (lens* NEAR/4 (extract* OR aspirat* OR operat* OR remov* OR surg* OR excis* OR implant* OR emulsif*)) :ab,ti
#36 'cataract extraction'/exp
#37 'cataract extraction':ab,ti OR 'cataract extractions':ab,ti OR phakectomy*:ab,ti OR zonulolysis*:ab,ti OR cataractom*:ab,ti
#38 'phacoemulsification'/exp
#39 pha*oemulsif*:ab,ti OR phaco:ab,ti OR phako:ab,ti OR capsular*hexis:ab,ti OR lensectom*:ab,ti
#40 'capsulorhexis'/exp
#41 microphaco*:ab,ti OR miniphaco*:ab,ti
#42 coaxial:ab,ti OR 'co axial':ab,ti OR biaxial:ab,ti OR bimanual:ab,ti OR microcoaxial:ab,ti OR 'micro coaxial':ab,ti
#43 'c mics':ab,ti OR 'b mics':ab,ti OR misics:ab,ti OR sics:ab,ti OR mics:ab,ti
#44 #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43
#45 'incision'/exp
#46 incision*:ab,ti OR microincision*:ab,ti
#47 'microsurgery'/de
#48 #45 OR #46 OR #47
#49 #32 AND #44 AND #48
```

Appendix 4. PubMed search strategy

```
1. ((randomized controlled trial[pt]) OR (controlled clinical trial[pt]) OR (randomised[tiab] OR randomized[tiab]) OR (placebo[tiab]) OR (drug therapy[sh]) OR (randomly[tiab]) OR (trial[tiab]) OR (groups[tiab])) NOT (animals[mh] NOT humans[mh])
2. (Cataract*[tiab] AND (extract*[tiab] OR aspirat*[tiab] OR operate*[tiab] OR operati*[tiab] OR remov*[tiab] OR surge*[tiab] OR surgi*[tiab] OR excis*[tiab] OR implant*[tiab])) NOT Medline[sb]
3. (lens*[tiab] AND (extract*[tiab] OR aspirat*[tiab] OR operate*[tiab] OR operati*[tiab] OR remov*[tiab] OR surge*[tiab] OR surgi*[tiab] OR excis*[tiab] OR implant*[tiab])) NOT Medline[sb]
4. (Phakectomy*[tiab] OR Zonulolysis*[tiab] OR cataractom*[tiab]) NOT Medline[sb]
5. (phaco*[tiab] OR phako*[tiab] OR Capsulorhexis[tiab] OR Capsulorrhesis[tiab] OR lensectom*[tiab]) NOT Medline[sb]
6. (Microphaco*[tiab] OR micro-phaco[tiab] OR miniphaco*[tiab]) NOT Medline[sb]
7. (Coaxial[tiab] OR co-axial[tiab] OR biaxial[tiab] OR bimanual[tiab] OR Microcoaxial[tiab] OR micro-coaxial[tiab]) NOT Medline[sb]
8. (C-MICS[tiab] OR B-MICS[tiab] OR MISICS[tiab] OR SICS[tiab] OR MICS[tiab]) NOT Medline[sb]
9. #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8
10. (Incision*[tiab] OR microincision*[tiab]) NOT Medline[sb]
11. #1 AND #9 AND #11
```

Appendix 5. LILACS search strategy

```
(MH:C11.510.245$ OR MH:E04.540.825.249$ OR E04.943.875$ OR phacoemulsif$ OR phakoemulsif$ OR facoemulsif$ OR phaco$ OR phako$ OR capsulorhexis OR capsulorrhesis OR phakectomy$ OR lensectom$ OR zonulolys$ OR cataractom$ OR cataract$ OR catarata$ OR lens$ OR Microphaco* OR miniphaco* OR Coaxial OR "co-axial" OR biaxial OR bimanual OR Microcoaxial OR "C-MICS" OR "B-MICS" OR MISICS OR SICS OR MICS) AND (MH:E04.494$ OR MH:E05.591.580$ OR E04.502$ OR Incision$ OR microincision$ OR microsurg$)
```

Appendix 6. metaRegister of Controlled Trials search strategy

```
(cataract OR Phacoemulsification OR Capsulorhexis OR phaco* OR phako* OR microphaco* OR Coaxial OR co-axial OR biaxial OR bimanual OR Microcoaxial OR MISICS OR SICS OR MICS) AND (incision* OR microincision* OR microsurgery)
```

Appendix 7. ClinicalTrials.gov search strategy

```
(Cataract OR Phacoemulsification OR Capsulorhexis OR phaco OR phako OR microphaco OR Coaxial OR "co-axial" OR biaxial OR bimanual OR Microcoaxial OR "C-MICS" OR "B-MICS" OR MISICS OR SICS OR MICS) AND (incision OR microincision OR microsurgery)
```

Appendix 8. WHO ICTRP search strategy

```
Cataract AND incision OR cataract AND microincision OR cataract AND microsurgery OR Phacoemulsification AND incision OR Phacoemulsification AND microincision OR Phacoemulsification AND microsurgery OR Phakoemulsification AND incision OR Phakoemulsification AND microincision OR Phakoemulsification AND microsurgery OR Capsulorhexis AND incision OR Capsulorhexis AND microincision OR Capsulorhexis AND microsurgery OR Capsulorrhesis AND incision OR Capsulorrhesis AND microincision OR Capsulorrhesis AND microsurgery OR Lensectomy AND incision OR Lensectomy AND microincision OR Lensectomy AND microsurgery OR phaco AND incision OR phaco AND microincision OR phaco AND microsurgery OR phako AND incision OR phako AND microincision OR phako AND microsurgery OR microphaco AND incision OR microphaco AND microincision OR microphaco AND microsurgery OR Coaxial
```

AND incision OR Coaxial AND microincision OR Coaxial AND microsurgery OR "co-axial" AND incision OR "co-axial" AND microincision OR "co-axial" AND microsurgery OR biaxial AND incision OR biaxial AND microincision OR biaxial AND microsurgery OR bimanual AND incision OR bimanual AND microincision OR bimanual AND microsurgery OR Microcoaxial AND incision OR Microcoaxial AND microincision OR Microcoaxial AND microsurgery

Phakectomy AND incision OR Phakectomy AND microincision OR Phakectomy AND microsurgery OR Zonulolyses AND incision OR Zonulolyses AND microincision OR Zonulolyses AND microsurgery OR Zonulolysis AND incision OR Zonulolysis AND microincision OR Zonulolysis AND microsurgery OR Cataractomy AND incision OR Cataractomy AND microincision OR Cataractomy AND microsurgery OR "C-MICS" AND incision OR "C-MICS" AND microincision OR "C-MICS" AND microsurgery OR "B-MICS" AND incision OR "B-MICS" AND microincision OR "B-MICS" AND microsurgery OR MISICS AND incision OR MISICS AND microincision OR MISICS AND microsurgery OR SICS AND incision OR SICS AND microincision OR SICS AND microsurgery OR MICS AND incision OR MICS AND microincision OR MICS AND microsurgery

CONTRIBUTIONS OF AUTHORS

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- Data collection for the review update
 - Designing search strategies: CEV Information Specialist
 - Undertaking searches: CEV Information Specialist
 - Screening search results: CJ, XC, XW, AL, Sarah Money (SM), Yuanxi Jia (YJ)
 - Organizing retrieval of papers: AL
 - Screening retrieved papers against inclusion criteria: CJ, XC, AL
 - Appraising quality of papers: CJ, XC, AL, YJ
 - Extracting data from papers: CJ, XC, AL, YJ, YK
 - Writing to authors of papers for additional information: CJ, XW
 - Obtaining and screening data on unpublished studies: CJ, AL
- Data management for the review
 - Entering data into Review Manager 5: AL, XW
 - Analysis of data: CJ, XC, AL
- Interpretation of data
 - Providing a methodological perspective: AL, XW
 - Providing a clinical perspective: CJ, XC, WX, KY
 - Providing a policy perspective: CJ, XC
 - Providing a consumer perspective: CJ, XC
- Writing the review: CJ, XC, AL
- Providing general advice on the review: CJ, XC, AL, WX, KY
- Securing funding for the review: N/A
- Performing previous work that was the foundation of the current study: N/A
- Guarantor for review: CJ

DECLARATIONS OF INTEREST

Chongfei Jin: is a coauthor of an included study ([Yao 2011](#))

Xinyi Chen: no conflicts of interest

Andrew Law: no conflicts of interest

Yunhee Kang: no conflicts of interest

Xue Wang: no conflicts of interest

Wen Xu: no conflicts of interest

Ke Yao: is a coauthor of three included studies ([Yao 2008](#); [Yao 2011](#); [Yu 2016](#))

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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

In the protocol, we planned to impute the missing data using statistical methods. We decided that with so little missing data in the included studies any imputation would not change the conclusions of the review.

In the protocol, we stated that "we will determine whether data synthesis can be done depending on the heterogeneity calculated. If the I^2 statistic suggests substantial statistical heterogeneity, we will present results in a narrative summary. If the I^2 statistic is less than 50% (not indicating substantial heterogeneity), we will combine study results." We decided that the I^2 statistic alone should not be the basis for our model selection. We used both clinical and methodological heterogeneity of the included studies to determine the appropriate model for meta-analysis.

In the protocol, we planned to study intraoperative parameters including use of cumulative dissipated energy, total use of balanced salt solution, and surgical time. However, we found that phacoemulsification time is also an important parameter of interest to surgery. We therefore added phacoemulsification time as a new outcome in the review.

In the protocol, our primary and secondary outcomes were to be reported at day one, days five to seven, one month, and six weeks to two months, as data were available. However, we decided to report the primary and secondary outcomes at three and 12 months to be consistent with other Cochrane Reviews on age-related cataract ([Ang 2014](#); [de Silva 2014](#); [Mathew 2012](#); [Riaz 2006](#); [Riaz 2013](#)); these are also the most clinically relevant postoperative time points. As studies may not have reported outcomes at precisely these time points, we considered data collection within the following time periods: three months' (from four weeks to six months) and 12 months' (from six months to less than 18 months) postoperatively.

In the protocol, we did not specify use of the GRADE approach and presenting of 'Summary of findings' tables for four comparisons, as this was not the Cochrane standard at the time.

INDEX TERMS

Medical Subject Headings (MeSH)

*Cataract; *Surgical Wound; Astigmatism [*etiology]; Corneal Edema [etiology]; Corneal Pachymetry; Phacoemulsification [adverse effects] [*methods]; Postoperative Complications [*etiology]; Randomized Controlled Trials as Topic; Visual Acuity

MeSH check words

Humans