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Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery (Review)

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[Intervention Review]

Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery

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ABSTRACT

Background

Cataract is the leading cause of blindness in the world and, as such, cataract surgery is one of the most commonly performed operations globally. Surgical techniques have changed dramatically over the past half century with associated improvements in outcomes and safety. Femtosecond lasers can be used to perform the key steps in cataract surgery, such as corneal incisions, lens capsulotomy and fragmentation. The potential advantage of femtosecond laser-assisted cataract surgery (FLACS) is greater precision and reproducibility of these steps compared to manual techniques. The disadvantages are the costs associated with FLACS technology.

Objectives

To compare the effectiveness and safety of FLACS with standard ultrasound phacoemulsification cataract surgery (PCS) by gathering evidence from randomised controlled trials (RCTs).

Search methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL; which contains the Cochrane Eyes and Vision Trials Register; 2022, Issue 5); Ovid MEDLINE; Ovid Embase; LILACS; the ISRCTN registry; ClinicalTrials.gov; the WHO ICTRP and the US Food and Drug Administration (FDA) website. We did not use any date or language restrictions in the electronic searches for trials. We last searched the electronic databases on 10 May 2022.

Selection criteria

We included RCTs where FLACS was compared to PCS.

Data collection and analysis

Three review authors independently screened the search results, assessed risk of bias and extracted data using the standard methodological procedures expected by Cochrane. The primary outcome for this review was intraoperative complications in the operated eye, namely anterior capsule, and posterior capsule tears. The secondary outcomes included corrected distance visual acuity (CDVA), quality of vision (as measured by any validated patient-reported outcome measure (PROM)), postoperative cystoid macular oedema complications, endothelial cell loss and cost-effectiveness. We assessed the certainty of the evidence using GRADE.

Main results

We included 42 RCTs conducted in Europe, North America, South America and Asia, which enrolled a total of 7298 eyes of 5831 adult participants. Overall, the studies were at unclear or high risk of bias. In 16 studies the authors reported financial links with the manufacturer of the laser platform evaluated in their studies. Thirteen of the studies were within-person (paired-eye) studies with one eye allocated to one procedure and the other eye allocated to the other procedure. These studies were reported ignoring the paired nature of the data.

There was low-certainty evidence of little or no difference in the odds of developing anterior capsular tears when comparing FLACS and PCS (Peto odds ratio (OR) 0.83, 95% confidence interval (CI) 0.40 to 1.72; 5835 eyes, 27 studies) There was one fewer anterior capsule tear per 1000 operations in the FLACS group compared with the PCS group (95% CI 4 fewer to 3 more).

There was low-certainty evidence of lower odds of developing posterior capsular tears with FLACS compared to PCS (Peto OR 0.50, 95% CI 0.25 to 1.00; 5767 eyes, 26 studies). There were four fewer posterior capsule tears per 1000 operations in the FLACS group compared with the PCS group (95% CI 6 fewer to same).

There was moderate-certainty evidence of a very small advantage for the FLACS arm with regard to CDVA at six months or more follow-up, (mean difference (MD) -0.01 logMAR, 95% CI -0.02 to 0.00; 1323 eyes, 7 studies). This difference is equivalent to 1 logMAR letter between groups and is not thought to be clinically important.

From the three studies (1205 participants) reporting a variety of PROMs (Cat-PROMS, EQ-5D, EQ-SD-3L, Catquest9-SF and patient survey) up to three months following surgery, there was moderate-certainty evidence of little or no difference in the various parameters between the two treatment arms.

There was low-certainty evidence of little or no difference in the odds of developing cystoid macular oedema when comparing FLACS and PCS (Peto OR 0.84, 95% CI 0.56 to 1.28; 4441 eyes, 18 studies). There were three fewer cystoid macular oedema cases per 1000 operations in the FLACS group compared with the PCS group (95% CI 10 fewer to 6 more).

In one study the incremental cost-effectiveness ratio (ICER) (cost difference divided by quality-adjusted life year (QALY) difference) was GBP £167,620 when comparing FLACS to PCS. In another study, the ICER was EUR €10,703 saved per additional patient who had treatment success with PCS compared to FLACS. Duration ranged from three minutes in favour of FLACS to eight minutes in favour of PCS (I^2 = 100%, 11 studies) (low-certainty evidence).

There was low-certainty evidence of little or no important difference in endothelial cell loss when comparing FLACS with PCS (MD 12 cells per mm^2 in favour of FLACS, 95% CI -40 to 64; 1512 eyes, 10 studies).

Authors' conclusions

This review of 42 studies provides evidence that there is probably little or no difference between FLACS and PCS in terms of intraoperative and postoperative complications, postoperative visual acuity and quality of life. Evidence from two studies suggests that FLACS may be the less cost-effective option. Many of the included studies only investigated very specific outcome measures such as effective phacoemulsification time, endothelial cell count change or aqueous flare, rather than those directly related to patient outcomes. Standardised reporting of complications and visual and refractive outcomes for cataract surgery would facilitate future synthesis, and guidance on this has been recently published.

PLAIN LANGUAGE SUMMARY

Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery

Key messages

- There are probably no clinically important differences between the two methods of cataract surgery in terms of complications, visual acuity (ability to distinguish shapes and objects at a given distance) and quality of life.

- Femtosecond laser-assisted cataract surgery (FLACS) was more expensive and there was some evidence that phacoemulsification cataract surgery (PCS) may be more cost-effective.

- There were differences in how studies reported outcomes: standardised outcome reporting would help future comparisons.

What is a cataract?

Cataract is clouding of the lens inside the eye. It is the leading cause of blindness in the world.

What is cataract surgery?

Cataract surgery is one of the most performed operations globally. During standard surgery, the surgeon opens the front of the lens capsule (the lens outer layer or 'skin'), removes the cloudy lens material inside the capsule and places a clear artificial lens in the remaining capsular

bag. The aim of femtosecond laser-assisted cataract surgery (FLACS) is to provide more precise control over the steps involved in cataract surgery. By being more precise, it is plausible that this could lead to better outcomes or higher safety for people undergoing cataract surgery.

What did we want to find out?

The aim of this Cochrane Review was to find out what the benefits and harms of FLACS are compared with standard ultrasound PCS.

What did we do?

We searched for studies that compared PCS to FLACS in people with age-related cataracts. We compared and summarised the results of the studies and rated our confidence in the evidence, based on factors such as study methods and study size.

What did we find?

The analysis included 42 studies that involved 5831 people. The studies were conducted in countries around the world; most were done in Europe (25). All of these studies compared FLACS with PCS for people with cataracts. Sixteen of the studies were either funded by the manufacturer of the laser machine or the investigators reported financial links with the manufacturer.

Overall, there was some uncertainty as to whether FLACS reduces the number of tears to the lens capsule because there were very few cases of capsule tears in both the manual and laser-assisted cataract surgeries in these studies. Based on the data available, any difference in capsule complications is expected to be small. The capsule is a delicate membrane that originally covered the natural lens and holds the artificial lens following surgery. Tears in the capsule can adversely affect the visual outcomes following cataract surgery and may necessitate further surgery. Other complications were also infrequent for both laser-assisted and standard cataract surgery. Based on the data available, any difference in postoperative visual outcomes is also expected to be small.

Only three studies reported the effect of the operations on people's quality of life and there is probably little or no difference when comparing FLACS and PCS.

FLACS was the more expensive option and two studies reported that it was less cost-effective.

What are the limitations of the evidence?

Our confidence in the evidence is low because of concerns about the fact that patients and assessors were aware of which treatment they were receiving or providing, respectively. Furthermore, not all of the studies provided data about everything we were interested in. Lastly, the evidence is also based on few cases of events in some areas.

How up-to-date is this evidence?

We searched for studies that had been published up to 10 May 2022.

SUMMARY OF FINDINGS

Summary of findings 1. Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery

Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery

Patient or population: people with age-related cataract
Setting: eye hospital
Intervention: laser-assisted cataract surgery
Comparison: standard ultrasound phacoemulsification cataract surgery

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (Peto odds ratio) (95% CI)	№ of eyes (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with standard ultrasound phacoemulsification	Risk with laser-assisted cataract surgery				
Intraoperative complications: anterior capsule tear	6 per 1000	5 per 1000 (2 to 9)	0.83 (0.40 to 1.72)	5830 (27 RCTs)	⊕⊕⊖⊖ Low[1]	—
Intraoperative complications: posterior capsule tear	8 per 1000	4 per 1000 (2 to 8)	0.50 (0.25 to 1.00)	5767 (26 RCTs)	⊕⊕⊖⊖ Low[2]	—
Corrected distance visual acuity assessed with: logMAR acuity chart (lower scores = better vision, scale from: -0.3 to 1.3) 6 months or longer after surgery	The mean corrected distance visual acuity ranged from -0.06 to 0.05 logMAR units	The mean corrected distance visual acuity in the laser group was 0.01 logMAR units lower (better vision) (0.02 lower to 0.00)	—	1323 (7 RCTs)	⊕⊕⊕⊖ Moderate[3]	—
Patient-reported outcome measures (PROMs) at least 1 month after surgery	Measures included Cat-PROMS, EQ-5D, EQ-SD-3L, Catquest9-SF and patient survey. Differences between groups were small, likely to be clinically unimportant and were statistically non-significant.			1205 people (3 RCTs)	⊕⊕⊕⊖ Moderate[4]	—
Postoperative complications: cystoid macular oedema	22 per 1000	19 per 1000 (12 to 28)	0.84 (0.56 to 1.28)	4441 (18 RCTs)	⊕⊕⊖⊖ Low[5]	—

Costs and resource use: total duration of procedure	In one study the incremental cost-effectiveness ratio (ICER) (cost difference divided by QALY difference) was GBP £167,620 when comparing FLACS to PCS. In another study, the ICER was EUR €10,703 saved per additional patient who had treatment success with PCS compared to FLACS. Duration ranged from 3 minutes in favour of FLACS to 8 minutes in favour of PCS (I^2 = 100%, 11 studies).			2040 (11 RCTs)	⊕⊕⊖⊖ Low [6]	—
Postoperative endothelial cell loss	The mean endothelial cell loss ranged from 575 to 77 cells/mm^2	12 cells per mm^2 lower endothelial cells loss with FLACS (-40 to 64)	—	1512 (10 RCTs)	⊕⊕⊖⊖ Low[7]	Endothelial cell count final value 24 cells/mm^2 (95% CI -20 to 68, 10 studies, 1836 eyes, I^2 = 26%)

*__The risk in the intervention group__ (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). The risk in the comparison group was the median risk in the included trials.

CI: confidence interval; **FLACS:** femtosecond laser-assisted cataract surgery; **OR:** odds ratio; **PCS:** phacoemulsification cataract surgery; **QALY:** quality-adjusted life year; **RCT:** randomised controlled trial

GRADE Working Group grades of evidence
High-certainty: We are very confident that the true effect lies close to that of the estimate of the effect
Moderate-certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low-certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
Very low-certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

[1]Downgraded for: risk of bias (-1) because studies were poorly reported and largely judged to be at unclear or high risk of bias, and for imprecision (-1) as the number of events was low and confidence intervals included clinical benefit or harm.
[2]Downgraded for: risk of bias (-1) because studies were poorly reported and largely judged to be at unclear or high risk of bias, and for imprecision (-1) as the number of events was low and confidence intervals included clinical benefit or harm.
[3]Downgraded for: risk of bias (-1) because studies were poorly reported and largely judged to be at unclear or high risk of bias. We did not downgrade for imprecision because the confidence intervals did not include a clinically important difference.
[4]Downgraded for: risk of bias (-1) because studies were poorly reported and largely judged to be at unclear or high risk of bias.
[5]Downgraded for: risk of bias (-1) because studies were poorly reported and largely judged to be at unclear or high risk of bias, and for imprecision (-1) as the number of events was low and confidence intervals included clinical benefit or harm.
[6]Downgraded for: risk of bias (-1) because studies were poorly reported and largely judged to be at unclear or high risk of bias, and for inconsistency (-1) as different results were seen in different studies.
[7]Downgraded for: risk of bias (-1) because studies were poorly reported and largely judged to be at unclear or high risk of bias, and for inconsistency (-1) (I^2 = 51%).

BACKGROUND

Description of the condition

Age-related cataract is the leading cause of visual impairment worldwide (Quigley 2006), and cataract surgery is one of the most commonly performed eye operations worldwide. Preferred surgical techniques have changed dramatically over the past half century, with associated improvements in outcomes and safety (Riaz 2006). With this increase in safety and improvements in visual outcomes, lens extraction with intraocular lens implantation is now increasingly performed for the treatment of other conditions, including refractive error (termed refractive lens exchange) and angle closure glaucoma (Ong 2021; Packard 2005).

Description of the intervention

Lasers have been used in corneal surgery for more than two decades. More recently, femtosecond laser platforms that may accurately and reproducibly perform key steps in cataract surgery, including corneal incisions, capsulotomy and lens fragmentation, are now available. The potential advantages of femtosecond laser-assisted cataract surgery (FLACS) are possible improvements in safety and visual outcomes through greater precision and reproducibility, compared to manual techniques. However, these systems are associated with increased costs, both directly in terms of financial outlay for the technology, its maintenance and individual patient disposable devices to couple the patients' eye to the laser system, as well as increased surgical time to perform the laser steps. However, it is possible that some of these costs could be mitigated by a reduction in complication rates, less repeat surgery and better patient outcomes (Roberts 2018).

How the intervention might work

Phacoemulsification (ultrasound) cataract surgery (PCS) is a highly successful technique first introduced over 40 years ago. It is the standard method of cataract surgery today in higher-income countries, with reported rates of major complications (posterior capsule rupture (PCR) or vitreous loss) having halved over the past decade with, for example, 0.9% of operations being affected by PCR in the UK Royal College of Ophthalmologists National Ophthalmology Audit 2020-2021 (Annual Report 2022 National Cataract Audit). It consists of a series of manual steps, including corneal incision creation, capsulorhexis (circular opening of the front of the cataract lens capsule), removal of the cataract with ultrasound and placement of an intraocular lens into the capsular bag. Each step is dependent on successful completion of the preceding steps and, therefore, surgical ability is critical to visual outcome.

Femtosecond laser cataract surgery platforms first became available over 10 years ago and have revolutionised corneal surgery, such as for LASIK flap creation. Femtosecond lasers can automate some of the early key steps of cataract surgery, such as creation of the corneal incisions (with or without additional incisions to reduce astigmatism - astigmatic keratotomies), lens capsulotomy and lens fragmentation, in order to facilitate lens removal. The remaining steps are removal of the fragmented crystalline lens with phacoemulsification and insertion of the intraocular lens, which must still be completed manually. The femtosecond laser platforms use photo-dissection to create tissue planes accurate to 5 µm in the anterior segment through the formation of cavitation bubbles, and as the focused pulses are ultrashort (10^{-15} seconds), this is thought to almost eliminate any collateral damage to surrounding tissues. The laser energy imparted to the eye, however, should not be insignificant.

While the overall range of possible operative complications in either FLACS or PCS is similar, rates might be expected to be lower with FLACS procedures as laser-completed steps should be more precise and more reproducible than those completed manually. This could translate to fewer postoperative complications and better patient outcomes. In FLACS, there is reportedly more accurate capsulotomy positioning, shape and size when compared to manual capsulorhexis (Friedman 2011; Kránitz 2011; Nagy 2011). This has been reported to be associated with better intraocular lens centration (ensuring correct centring of the lens) (Kránitz 2011; Kránitz 2012; Nagy 2011), and less intraocular lens tilt with fewer internal higher order aberrations (Kránitz 2012; Mihăltz 2011). By using a laser to fragment the crystalline lens, less phacoemulsification (ultrasound) energy has been reported to be required to complete its removal (Kránitz 2011).

Why it is important to do this review

Laser-assisted lens surgery platforms are now increasingly being used for lens extraction and intraocular lens implantation. There are currently five commercially available systems in Europe: Catalys™ (Abbott Medical Optics), LENSAR™ (LENSAR Inc), LenSx® (Alcon), VICTUS™ (Bausch & Lomb Inc) and the Femto LDV Z8 (Ziemer). The aims of this review are to compare the effectiveness of FLACS with PCS and gather evidence from randomised controlled trials (RCTs) on safety and outcomes.

OBJECTIVES

To compare the effectiveness and safety of femtosecond laser-assisted cataract surgery (FLACS) with standard ultrasound phacoemulsification cataract surgery (PCS) by gathering evidence from randomised controlled trials (RCTs).

METHODS

Criteria for considering studies for this review

Types of studies

We included all randomised controlled trials (RCTs) that compared FLACS to PCS in adults undergoing cataract surgery. We included both parallel-group studies, where people were randomised to FLACS or PCS, and within-person (paired-eye) studies in which the two eyes received different interventions.

Types of participants

We included all participants who were enrolled in the respective RCT whereby either the participant or one of their eyes was randomised to undergo cataract surgery, through either FLACS or PCS. Participants were adults (18 years old or more). Patients having clear lens extraction were excluded.

Types of interventions

We included all RCTs comparing FLACS to PCS, with implantation of a posterior chamber intraocular lens in both techniques.

Types of outcome measures

Primary outcomes

- The primary outcome was intraoperative complications in the operated eye.

Secondary outcomes

The secondary outcomes for this review were the following.

- Distance visual acuity in the operated eye after initial cataract surgery. We considered corrected distance visual acuity (CDVA) and uncorrected distance visual acuity (UDVA) separately. CDVA demonstrates intervention safety, whilst UDVA demonstrates intervention efficacy (see How the intervention might work above). We considered long-term data, where reported.
- Patient-reported outcome measures (PROMs) at least one month after surgery. These include patient satisfaction and/or vision-related quality of life as measured by any validated questionnaire, such as the Catquest9-SF.
- Any postoperative or long-term complications reported within one year of initial surgery. We anticipated that these may be reported as overall risk of any complication, or more specifically such as cystoid macular oedema, elevated intraocular pressure and posterior capsule opacification.
- Corneal endothelial counts (both absolute postoperative values and endothelial cell loss).
- Costs and resource use (e.g. total duration of procedure).
- Refractive outcomes, including deviation from the predicted refractive outcome.

Search methods for identification of studies

Electronic searches

The Cochrane Eyes and Vision Information Specialist searched the following databases for randomised controlled trials and controlled clinical trials. There were no restrictions to language or year of publication. The date of the search was 10 May 2022.

- Cochrane Central Register of Controlled Trials (CENTRAL 2022, Issue 5) (which contains the Cochrane Eyes and Vision Trials Register) in the Cochrane Library (searched 10 May 2022) (Appendix 1).
- MEDLINE Ovid (1946 to 10 May 2022) (Appendix 2).
- Embase Ovid (1980 to 10 May 2022) (Appendix 3).
- LILACS (Latin American and Caribbean Health Science Information database) (1982 to 10 May 2022) (Appendix 4).
- ISRCTN registry (www.isrctn.com/editAdvancedSearch; searched 10 May 2022) (Appendix 5).
- US National Institutes of Health Ongoing Trials Register ClinicalTrials.gov (www.clinicaltrials.gov; 10 May 2022) (Appendix 6).
- World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP) (www.who.int/ictrp; searched 10 May 2022) (Appendix 7).
- US Food and Drug Administration (FDA) website (www.fda.govp; searched 10 May 2022) (Appendix 8).

Searching other resources

We searched the reference lists of included studies to identify any additional trials. We did not handsearch conference proceedings or journals for this review.

Data collection and analysis

Selection of studies

Three review authors (ACD, AN, DMG) working independently reviewed the titles and abstracts from the electronic literature searches. They removed duplicate records and obviously irrelevant reports. They classified abstracts as 'exclude', 'unsure' or 'include'. The full text for abstracts classified as 'unsure' by both review authors were retrieved and reassessed for inclusion. They sought to link together multiple reports of the same study. They planned to deal with potential discrepancies on unclear studies by contacting the trial authors for clarification and additional information, however this was not required. Studies labelled as 'exclude' by both review authors were excluded, and those labelled 'include' were assessed for risk of bias. We organised translation of non-English language reports, as needed.

Data extraction and management

Three review authors (ACD, AN, DMG) extracted data using a standard form developed by Cochrane Eyes and Vision. We compared these and resolved discrepancies by discussion. Two authors (ACD, AN) entered the data into Review Manager 5.4 (RevMan 2020), following the guidelines set out in Chapter 7 of the *Cochrane Handbook for Systematic Reviews of Interventions* and this was verified by a second review author (DMG) (Higgins 2011).

We collected data on the following characteristics:

- Study design (parallel-group RCT/within-person study)
- Number of participants and eyes randomised (total, by group)
- Country
- Age and sex
- Inclusion and exclusion criteria
- Details of intervention and comparator
- Outcomes
- Funding source
- Declaration of interest
- Date study conducted
- Trial registration number

For each pre-specified review outcome, where available, we collected data on the number of events/total by group for dichotomous variables and mean, standard deviation and total by group for continuous variables. If the standard deviation was not reported, we calculated this using other reported data (e.g. confidence interval or standard error) using the RevMan Web calculator.

Assessment of risk of bias in included studies

Each review author independently assessed risk of bias in the included studies using the recommended tool in Chapter 8 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2017). We assessed studies for the following criteria: sequence generation and allocation concealment (selection bias), masking

(blinding) of participants and personnel (performance bias) and outcome assessors (detection bias), incomplete outcome data (attrition bias) and selective outcome reporting (reporting bias).

Selection bias

We considered adequacy of random sequence generation and allocation concealment. Methods of sequence generation considered to be at low risk of bias include referring to random number tables or a list of random assignments generated by a computer. Methods at high risk of bias include sequence generation, for example, by odd or even dates of birth. We assessed any method of allocation concealment (such as central randomisation, use of sequentially numbered, opaque, sealed envelopes) that meets or exceeds the minimal criteria for judging concealment of allocation sequence (as detailed in section 8.10 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2017)) at low risk of bias. Methods such as using an open random allocation schedule may allow participants or investigators to possibly foresee assignment, thus introducing selection bias, and we judged such studies at high risk of bias.

Performance and detection bias

We considered the masking of outcome assessors by study outcomes or group of outcomes in the included studies. Masking of surgeons and participants was not possible with the interventions being examined. High risk of bias was defined as no masking, or incomplete masking, where the outcome was considered likely to be influenced by lack of masking; or if masking of the outcome assessor was attempted, but it was likely that the masking could have been broken, and the outcome measurement was likely to be influenced by a lack of masking.

Attrition bias

We examined for missing outcome data, rates of follow-up, reasons for losses to follow-up and analysis by the principle of intention-to-treat. This included whether follow-up rates for the laser-assisted lens surgery and manual phacoemulsification arms were similar, and whether there were missing data for the outcomes of interest. We considered studies to be at low risk of bias if, for example, there were no missing data or reasons for missing outcome data were unlikely to be related to the outcomes.

Reporting bias

We investigated for selective reporting by comparing published reports to the study protocol, when available. We considered a study to be at low risk of bias if the outcomes of interest were reported in the prespecified way in both the protocol and in the published report. We considered the risk of bias to be high if, for example, not all the study's prespecified primary outcomes were reported.

The judgement for each criterion was reported as 'satisfactory' (low risk of bias), 'unsatisfactory' (high risk of bias) or 'unclear' (insufficient information to assess). Review authors were not masked to the report authors and trial results during the assessment, and any disagreements between the review authors were resolved by discussion. We planned to contact the report authors for additional information on issues that were unclear after reviewing the original study report, however this was not required.

Measures of treatment effect

Our primary outcome was a dichotomous outcome (whether or not the eye suffers a complication during surgery). We used the Peto odds ratio (OR) with 95% confidence intervals (CIs). For continuous outcomes we used the mean difference (MD) between comparison groups with 95% CIs.

Unit of analysis issues

Some outcome measures apply to eyes, e.g. refractive error, and some to people e.g. quality of life.

The main unit of analysis issue is how the studies dealt with both eyes. There are three options: (i) people are randomised to intervention/comparator and one eye per person is enrolled in the trial; (ii) people are randomised, but both eyes are included, and the same intervention/comparator is applied to both eyes; (iii) one eye is randomly allocated to intervention and the other eye to comparator (within-person study). We documented which design was used. We planned to record whether the study authors stated explicitly why they opted for a particular design, how the study eye was selected and, for within-person studies, how each eye was randomised but in the event none of the included studies provided this level of information.

We had hoped to explore whether the differences in trial designs, namely unilateral versus bilateral (paired-eye studies) impacted on the results. Whilst we found both paired and unpaired studies in our review, the paired studies had been analysed as unpaired. Analysis ignoring this pairing lowers the chance of detecting a significant difference between groups, but data were not presented in a way that allowed us to explore this.

Dealing with missing data

We originally planned to contact the original investigators where any data regarding prespecified trial outcomes were not reported in the final publication, however this was not required (except for the trial Schargus 2015, where we were provided with the postoperative CDVA standard deviation values following request). We have done an available case analysis - none of the studies had performed any imputation.

Assessment of heterogeneity

We assessed for methodological and statistical heterogeneity by careful review of the studies, examination of the forest plots of results of the studies, and by examining the I^2 statistic (%) to assess inconsistency between studies (Higgins 2003). We typically regarded an I^2 value of 50% as indicative of substantial inconsistency but our interpretation of the magnitude of I^2 was also based on consideration of the results of a Chi^2 test for heterogeneity and consistency between effect estimates.

Assessment of reporting biases

We planned to investigate publication bias by examination of funnel plots for signs of asymmetry. However, there were not sufficient trials contributing data to the meta-analyses (fewer than 10) to make this worthwhile.

Data synthesis

We performed data analysis according to Chapter 9 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Deeks 2017). We

pooled data using a random-effects model, unless data were sparse (for example, three or fewer trials contributing to the analysis), which could present problems estimating a random-effects model. In this scenario, we used a fixed-effect model but compared the findings between fixed-effect and random-effects models. When we considered heterogeneity to be substantial, we did not conduct a meta-analysis but instead provided a narrative interpretation of the results.

Subgroup analysis and investigation of heterogeneity

To date there are five commercially available femtosecond laser cataract surgery systems: Catalys™ (Abbott Medical Optics Inc), LENSAR™ (LENSAR Inc), LenSx® (Alcon), VICTUS™ (Bausch & Lomb Inc) and the Femto LDV Z8 (Ziemer Ophthalmic Systems AG), and it is possible that outcomes may differ between manufacturers. We therefore report the results detailing the platform manufacturer for each relevant study. Currently, there are not enough trials for a subgroup analysis.

Sensitivity analysis

We planned to conduct a sensitivity analysis excluding trials at high risk of bias, but there were too few RCTs judged at low risk of bias for each analysis to enable us to do this.

In response to peer review comments, for the outcomes both meta-analysed and included in the summary of findings table, we conducted a sensitivity analysis excluding within-person (paired-eye) studies.

Summary of findings and assessment of the certainty of the evidence

We prepared a summary of findings table presenting relative and absolute risks for the outcomes listed below. One review author (JE) independently assessed the overall certainty of the evidence for each outcome using the GRADE classification system (GRADEpro); this was checked by the other review authors.

1. Intraoperative complications: anterior capsule tear.
2. Intraoperative complications: posterior capsule tear.
3. Corrected distance visual acuity (CDVA) at least one month after surgery.
4. Patient-reported outcome measures (PROMs) at least one month after surgery.
5. Postoperative complications: cystoid macular oedema.
6. Costs and resource use: total duration of procedure.
7. Endothelial cell loss.

RESULTS

Description of studies

Results of the search

The electronic searches ran in 2016 yielded a total of 2208 references. The Cochrane Information Specialist removed 754 duplicate records and we screened the remaining 1454 reports. We rejected 1414 records after reading the abstracts and obtained the full-text reports of 40 references for further assessment. We identified 16 studies that met the inclusion criteria and excluded 13 studies (see Characteristics of excluded studies for details). In addition, we identified another 11 studies as ongoing or completed but with no data currently available. When the review is next updated we will check to see if these studies have published data and if so assess them for inclusion in the review.

An update search run in May 2022 yielded a further 1327 references (Figure 1). The Cochrane Information Specialist removed 454 duplicate records and pre-screened 873 records, removing 706 records that were not relevant to the scope of the review. We screened the remaining 167 reports of studies and rejected 124 records after reading the abstracts. We identified 43 references for further assessment. We identified 35 reports of 26 new studies that met the inclusion criteria. We excluded six studies (see Characteristics of excluded studies for details).

Figure 1.

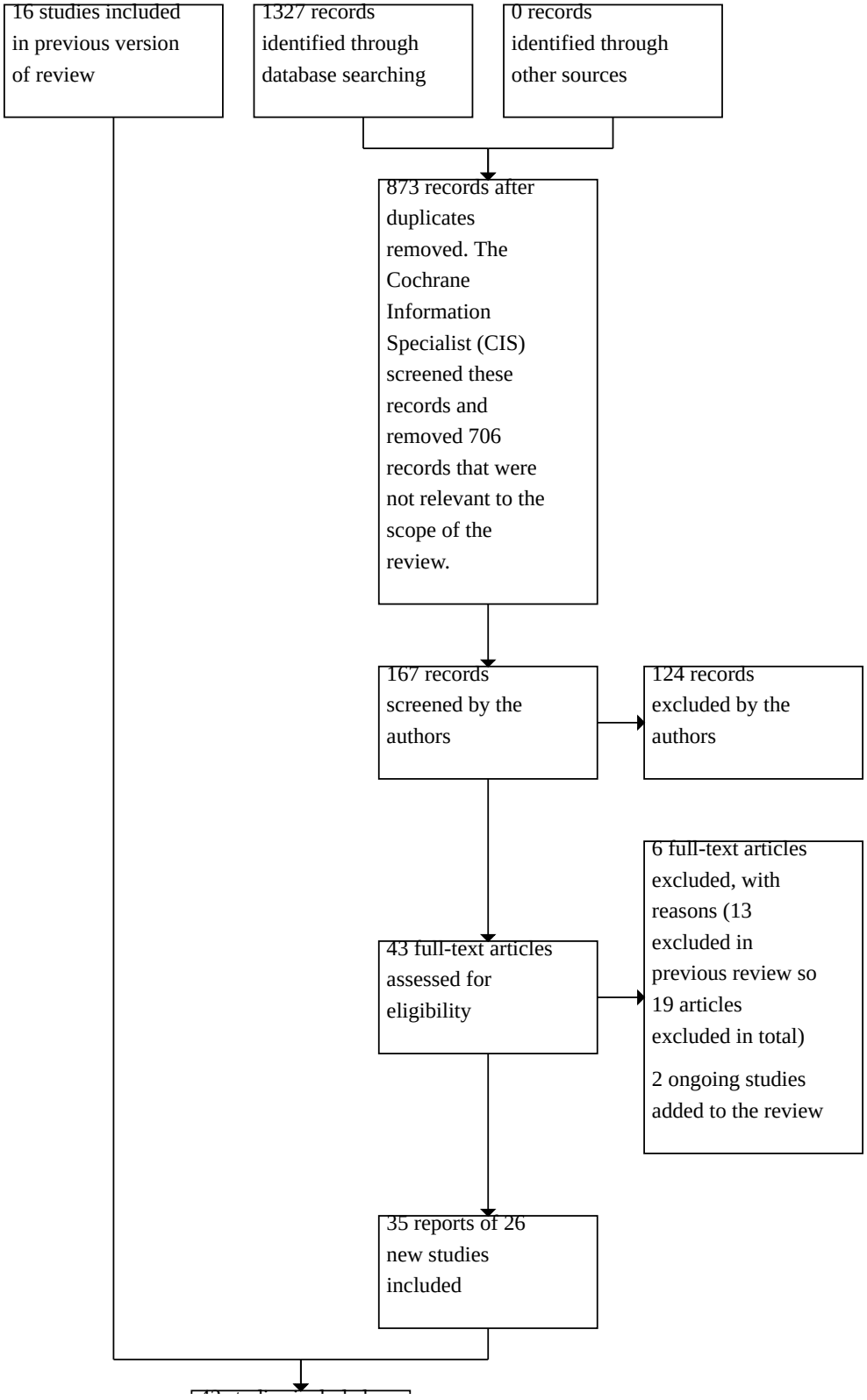
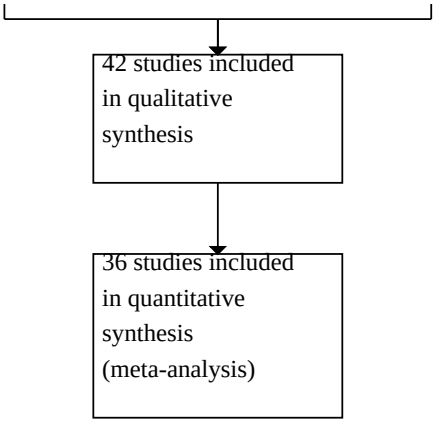


Figure 1. (Continued)



We identified two new ongoing studies for this update (NCT02974140; NCT03050008). In the previous version of this review there were 11 ongoing studies. For this update we checked the status of those studies and have added study protocols to the corresponding full-text report of trials that have been completed. The following studies still have no results posted: NCT01693211; NCT01769313; NCT01971177; NCT02110212; NCT02403206; NCT02561104.

Included studies

We included 42 RCTs conducted in Europe, North America, South America and Asia, which enrolled a total of 7298 eyes of 5831 adult participants. In 16 of the studies the authors reported financial links with the manufacturer of the laser platform evaluated in their studies.

Below is a summary of the 42 studies included in this review. Further details of these can be found in the Characteristics of included studies table.

Design

Thirteen studies were within-person controlled, where one eye of each participant had PCS and the other eye FLACS (Conrad-Hengerer 2013; Conrad-Hengerer 2014; Conrad-Hengerer 2015; Dick 2014; Dzhaber 2020; Krarup 2021; Liu 2021; Menapace 2022; Mursch-Edlmayr 2017; Oka 2021; Panthier 2017; Schargus 2015; Schwarzenbacher 2020). None of these studies did a paired analysis. We have used the data as reported.

The remaining studies were parallel-group RCTs (Chee 2021; Chen 2019; Day 2020; Donnenfeld 2018; Filkorn 2012; Hansen 2020; Hida 2014; Hida 2017; Kanellopoulos 2016; Khan 2017; Kovacs 2014; Kránitz 2012; Mastropasqua 2014a; Mastropasqua 2014b; Nagy 2011; Nagy 2014; Pahlitzsch 2018; Pajic 2017; Parra-Rodríguez 2016; Pedroza 2016; Reddy 2013; Roberts 2019; Schroeter 2021; Takacs 2012; Vasvada 2019; Yu 2015; Zhang 2016). Most of these trials included one eye per person. In Nagy 2011, 6% of enrolled participants had bilateral surgery (111 eyes, 105 people); in Yu 2015, 50% of cases were bilateral (54 eyes, 36 people), in Yu 2016, 30% cases were bilateral (39 eyes, 30 people); in Khan 2017, 4% of cases were bilateral (50 eyes, 48 people); in Schweitzer 2020, 63% of cases were bilateral (1389 eyes, 870 people) and in Hansen 2020, 40% of cases were bilateral (135 eyes, 96 people). No adjustment was made for within-person correlation in these studies. We have used the data as reported.

Participants

Within-person studies

The within-person studies Conrad-Hengerer 2013, Conrad-Hengerer 2014, Dick 2014, Schargus 2015 and Conrad-Hengerer 2015 (Germany) enrolled 75 participants (150 eyes), 104 participants (208 eyes), 53 participants (106 eyes), 37 participants (74 eyes) and 100 participants (200 eyes), respectively. Panthier 2017 (France) enrolled 33 participants (66 eyes). Mursch-Edlmayr 2017 (Austria) enrolled 50 participants (100 eyes). Dzhaber 2020 (United States) enrolled 67 participants (134 eyes). Liu 2021 (Singapore) enrolled 85 participants (170 eyes). Oka 2021 (Japan) enrolled 55 participants (110 eyes). Schwarzenbacher 2020 and Menapace 2022 (Austria) enrolled 40 participants (80 eyes) and 60 participants (120 eyes), respectively. Krarup 2021 (Denmark) enrolled 34 participants (20 eyes).

Parallel-group studies

For the parallel-group RCTs, Reddy 2013 (India) recruited a total of 131 participants (131 eyes). In Hungary, Kránitz 2012 enrolled 45 participants (45 eyes), Filkorn 2012 134 participants (134 eyes), Takacs 2012 76 participants (76 eyes), Nagy 2014 40 participants (40 eyes) and Kovacs 2014 79 participants (79 eyes). In Italy, Mastropasqua 2014a and Mastropasqua 2014b recruited 60 participants (60 eyes), and 90 participants (90 eyes), respectively. In Brazil, Hida 2014 recruited 80 participants (80 eyes) and Hida 2017 recruited 400 participants (400 eyes). In Mexico, Parra-Rodríguez 2016 enrolled 100 participants (100 eyes) and Pedroza 2016 65 participants (65 eyes). Kanellopoulos 2016 (Greece) enrolled133 participants (133 eyes). Pajic 2017 and Schroeter 2021 (Switzerland) recruited a total of 130 participants (130 eyes). Donnenfeld 2018 (United States) recruited 45 participants (45 eyes). Pahlitzsch 2018 (Germany) recruited a total of 343 participants (343 eyes). In the United Kingdom, Roberts 2019 recruited a total of 400 participants (400 eyes) and Day 2020 a total of 785 participants (785 eyes). Chen 2019 (China) recruited a total of 94 participants (94 eyes). Vasvada 2019 (India) recruited a total of

182 participants (182 eyes) . Chee 2021 (Singapore) recruited a total of 93 participants (93 eyes).

In six studies both eyes of some participants were reported: Nagy 2011 (Hungary) enrolled 105 participants (111 eyes); Yu 2015 recruited 36 participants (54 eyes) and Yu 2016 30 participants (39 eyes) (China); Khan 2017 (Pakistan) recruited 48 participants (50 eyes); Schweitzer 2020 (France) recruited 707 participants (1476 eyes); and Hansen 2020 (United States) recruited 96 participants (135 eyes).

Interventions

All included studies compared FLACS to PCS. Conrad-Hengerer 2013, Conrad-Hengerer 2014, Conrad-Hengerer 2015, Day 2020, Dick 2014, Donnenfeld 2018, Schargus 2015 and Schweitzer 2020 used the Catalys laser platform (OptiMedica, AMO). Chee 2021, Mursch-Edlmayr 2017, Panthier 2017 and Reddy 2013 used the VICTUS™ laser platform (Bausch & Lomb Technolas). Dzhaber 2020, Filkorn 2012, Hansen 2020, Hida 2014, Hida 2017, Kanellopoulos 2016, Khan 2017, Kovacs 2014, Kránitz 2012, Nagy 2011, Nagy 2014, Mastropasqua 2014a, Mastropasqua 2014b, Oka 2021, Pahlitzsch 2018, Parra-Rodríguez 2016, Roberts 2019, Takacs 2012, Vasvada 2019 and Zhang 2016 used the LenSx platform (Alcon Laboratories, Inc., Fort Worth, TX). Liu 2021, Menapace 2022, Pajic 2017, Schroeter 2021 and Schwarzenbacher 2020 used the Femto LDV Z8 (Ziemer Ophthalmic Systems AG, Port, Switzerland). In Pedroza 2016, it is unclear, but is presumed to be the LenSx platform. Krarup 2021, Yu 2015 and Yu 2016 used the LensAR platform. Chen 2019 did not specify the platform used.

Outcomes

Outcomes for each study are reported separately below.

Study	Outcomes
Chee 2021	One-month postoperative BCVA, endothelial cell count at 1 month postoperatively, the effective phacoemulsification time, surgical time, perioperative complications.
Chen 2019	Operation time, effective phacoemulsification time, cumulative dissipated energy and fluid amount were compared between the two groups; visual acuity, intraocular pressure, corneal endothelium count, aqueous flare and slit lamp, rate of corneal endothelium loss, level changes of serum inflammatory cytokines IL-6, IL-1β and TNF-α, postoperative complications. Follow-up was at: 1 day, 1 week, 1 month and 3 months.
Conrad-Hengerer 2013	Primary outcome measures: corneal endothelial cell loss and corneal thickness at 3 months. Additional data reported: effective phacoemulsification time, mean irrigation fluid volume, mean surgical time, intraoperative and postoperative complications.
Conrad-Hengerer 2014	Primary outcome measures: laser flare counts and changes in macular thickness and volume. Secondary outcome measures: absolute and effective phacoemulsification time, and intraoperative and postoperative complications. Follow-up was 6 months postoperatively.
Conrad-Hengerer 2015	Primary outcome measures were early and late CDVA and the deviation from the target refraction using the spherical equivalent refraction. Secondary outcome measures were anterior chamber depth and keratometry values.
Day 2020	Unaided distance visual acuity (logMAR) at 3 and 12 months following surgery on the study eye, corrected distance visual acuity (logMAR) at 3 and 12 months following surgery in the study eye, ocular complications within 3 and 12 months of surgery in the study eye. (A complication will be defined as any event that causes unintentional injury to an ocular structure, or requires additional treatment, or has a negative effect on a patient's health or eyesight), unaided and corrected visual acuity and complications in the second eye (for those with bilateral cataracts), and with both eyes open at 3 and 12 months following surgery on the study eye, proportion of patients with vision within 0.5 and within 1 dioptre of the intended refractive outcome at 3 and 12 months following surgery on the study eye, patient-reported outcome: vision health status at 3, 6 and 12 months: Catquest9-SF, cost-utility analysis: within-trial cost-effectiveness analyses at 12 months and expected cost-effectiveness over patient lifetime, corneal endothelial cell count (additional safety measure) in both eyes at 3 and 12 months following surgery in the study eye.
Dick 2014	Primary outcome measures: capsular bag diameters and intraindividual difference in millimetres. Additional data reported: phacoemulsification energy used. Follow-up was 3 months.
Donnenfeld 2018	The intraocular pressure at which wounds leaked and severity of wound leakage immediately post-surgery and 1 day, 2 weeks and 1 month postoperatively, evaluation of pupil size, sphere, cylinder,

	manifest refraction spherical equivalent, uncorrected distance visual acuity, corrected distance visual acuity, topography, slitlamp examination and surgical complications
Dzhaber 2020	Changes in postoperative endothelial cell density and central corneal thickness, targeted intraoperative parameters and included effective phacoemulsification time, cumulative dissipated energy, amount of balanced salt solution (BSS) use and operating time, as well as intraoperative complications. Postoperative outcomes were measured at 1 day, 1 week, 1 month and 3 months postoperatively.
Filkorn 2012	Manifest refraction spherical equivalent, CDVA, mean absolute error, mean error, postoperative keratometry.
Hansen 2020	CDVA, UDVA and undilated ophthalmologic examination at day 1, week 1, month 1 and month 3 postoperatively. Intraoperative complications and cumulative dissipative energy and irrigation fluid usage was noted. The surgeons filled out a questionnaire at the end of surgery and the patients also completed a questionnaire at the postoperative visits.
Hida 2014	Capsulotomy size and shape parameters. Additional data: intraoperative complications in the laser arm (there is no description of the occurrence or non-occurrence of complications in the manual phacoemulsification arm) and refractive outcomes. The follow-up period is not described.
Hida 2017	Cumulative dissipated energy, torsional time, longitudinal time (Intelligent Phaco IP), case time, fluid usage, aspiration time, pre- and postoperative endothelial cell count and intraoperative complications.
Kanellopoulos 2016	Refraction, visual acuity, keratometry, tomography, pachymetry, endothelial cell counts, intraocular pressure.
Khan 2017	Endothelial cell count, intraoperative and postoperative complications.
Kovacs 2014	Subgroup analysis of previous RCT (no further data on this given). Primary outcome measure: quantification of posterior capsule opacification at 18 to 26 months postoperatively. Additional data: intraocular lens tilt and decentration.
Kránitz 2012	Intraocular lens decentration and tilt, refraction, uncorrected distance visual acuity (UDVA) and corrected distance visual acuity (CDVA).
Krarup 2021	Central corneal thickness, corneal light backscatter, corneal densitometry, and central corneal endothelial cell count and hexagonality (noncontact endothelial cell microscope), and corrected distance visual acuity (CDVA) were assessed preoperatively and at day 1, 40 and 180 postoperatively.
Liu 2021	Phacoemulsification energy parameters (cumulative dissipated energy, phacoemulsification power and phacoemulsification time), uncorrected and corrected distance visual acuities (UCDVA and BCDVA), manifest refraction spherical equivalent (MRSE), central corneal thickness (CCT), endothelial cell count (ECC), anterior chamber flare, and postoperative complications were obtained for 1 year. Aqueous humour was collected for the analysis of prostaglandin (PGE)2, cytokines and chemokines concentrations. Patient-reported outcomes on surgical experiences were evaluated using an in-house questionnaire.
Mastropasqua 2014a	Uncorrected distance visual acuity (UDVA), CDVA, keratometric astigmatism, corneal endothelial cell count, corneal thickness at the incision site and higher order corneal aberrations. Follow-up was 6 months.
Mastropasqua 2014b	Stated aim to report capsulotomy features including circularity and size. Study also reports UDVA and CDVA, subjective refraction data.

Menapace 2022	Change of central macular thickness (CMT) at 1 week, 3 weeks and 6 weeks postoperatively, effective phacoemulsification time, central macular volume (CMV) and total macular volume (TMV) changes at 1 week, 3 weeks and 6 weeks postoperatively.
Mursch-Edlmayr 2017	Intraoperative and postoperative complications and the effective phacoemulsification time (EPT); intraocular lens and capsulotomy centration; CDVA, endothelial cell density (ECD), central corneal thickness (CCT), and central retinal thickness. Follow-up was at: 1 day, 1 week, 1 month, 3 months and 6 months.
Nagy 2011	Circularity and area of capsulotomy, intraocular lens decentration.
Nagy 2014	Surgically induced astigmatism and corneal higher order aberrations. Additional data reported: intraoperative and postoperative complications. Follow-up was 3 months.
Oka 2021	Cumulative dissipated energy recorded after the ultrasound portion of the surgery, percent change of endothelial cell density at day 150 to 210 compared with the preoperative visit, average torsional amplitude on surgery day, central corneal thickness and corrected distance visual acuity.
Pahlitzsch 2018	Cumulative dissipated energy, balanced salt solution volume, total longitudinal energy, torsional amplitude, visual acuity was assessed pre-operatively, 1 day, 1 week and 1 month post-surgery. The safety parameter intraocular flare value was observed preoperatively and 1 week postoperatively.
Pajic 2017	Best corrected visual acuity (BCVA) up to 3 months after surgery, effective phacoemulsification time (EPT, seconds), mean phacoemulsification time and complications.
Panthier 2017	Capsulotomy parameters, effective lens position, refractive error, corrected distance visual acuity.
Parra-Rodríguez 2016	Endothelial cell count, coefficient of variation and hexagonality with follow-up at 1, 3 and 6 months postoperatively.
Pedroza 2016	Endothelial cell count, central corneal thickness, phacoemulsification parameters.
Reddy 2013	Primary outcome measure: effective phacoemulsification time. Secondary outcome measures: mean phacoemulsification energy, mean phacoemulsification time, volume of balanced salt solution, subjective surgeon assessment of ease of phacoemulsification. Additional data reported: capsulotomy comparisons, intraocular lens decentration, safety data including posterior capsule tear and iris damage. Follow-up was limited to 1 day postoperatively.
Roberts 2019	The UDVA at 4 weeks, intraoperative and postoperative complications, refraction, corneal thickness and endothelial cell loss, with quality of life outcomes and patient-reported quality of vision preoperatively and at 4 weeks postoperatively. The CDVA at 12 months, postoperative complications, refraction, corneal thickness and endothelial cell loss, quality of life outcomes and patient-reported quality of vision results.
Schargus 2015	Primary outcome: corneal endothelial cell count measurements. Secondary outcomes: corneal thickness, intraocular pressure, CDVA, overall surgery time and quantity of fluid passing through the eye. Follow-up was 6 months.
Schroeter 2021	Endothelial corneal cell density, coefficient of variation of endothelial cell area, percentage of hexagonal cells, effective phacoemulsification time, best corrected visual acuity, refraction with regards to mean absolute error, capsulotomy precision.
Schwarzenbacher 2020	IL-1b, IL-6 and total prostaglandin concentrations in anterior chamber aqueous humour.
Schweitzer 2020	The primary clinical outcome measure was the difference between the 2 treatment arms in the proportion of eyes classified as having treatment success. Treatment success was a composite of all 4 of the following events at 3 months: (1) absence of severe intraoperative or postoperative compli-

	cations up to month 3; (2) a BCVA of 0.0 LogMAR or better; (3) an absolute manifest refractive error of 0.75 dioptres or less; and (4) postoperative changes in corneal astigmatism power of 0.5 dioptres or less and astigmatism axis of 20° or less, incremental cost-effectiveness ratio (ICER) for FLACS versus PCS, mean surgery time, mean total ultrasound time, mean cumulative dissipated energy, mean aspiration time, volume of BSS used during surgery, central corneal thickness, endothelial cell count, intraocular pressure (IOP), Tyndall – number of cells, central macular thickness, peripapillary retinal nerve fibre layer thickness.
Takacs 2012	Postoperative central corneal oedema, endothelial cell count and endothelial cell function expressed by volume stress index.
Vasvada 2019	Central corneal thickness (CCT), corneal clarity, AC cells and flare, endothelial cell density (ECD), coefficient of variance, hexagonality and uncorrected distance visual acuity (UDVA).
Yu 2015	Various outcome measures including average and effective phacoemulsification time, total cataract surgery time, capsulotomy size, corneal endothelial cell density, postoperative refraction and CDVA.
Yu 2016	Morphology of the capsulotomy cutting edge by light microscopy, and cells, electrolytes and proteins in the aqueous humour by mass spectrometry.
Zhang 2016	Phacoemulsification parameters, capsulotomy diameter and circularity, corneal endothelial cell loss, postoperative anterial chamber flare, complications, visual acuity

Excluded studies

We excluded 19 studies and details of these are in the Characteristics of excluded studies table.

In total, 16 of the 19 studies were excluded as they were not RCTs. We excluded one study as we could only find a conference abstract and there was insufficient information to determine if it was a RCT. In one study, patients in both arms underwent laser-assisted cataract surgery. The final study was excluded as were unable to source the paper from either the journal website or the contact author. None of these were key studies whose findings the stakeholders might be interested in.

Risk of bias in included studies

We assessed the included studies for possible biases, with findings as below.

Allocation

See Figure 2.

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias in each included study.

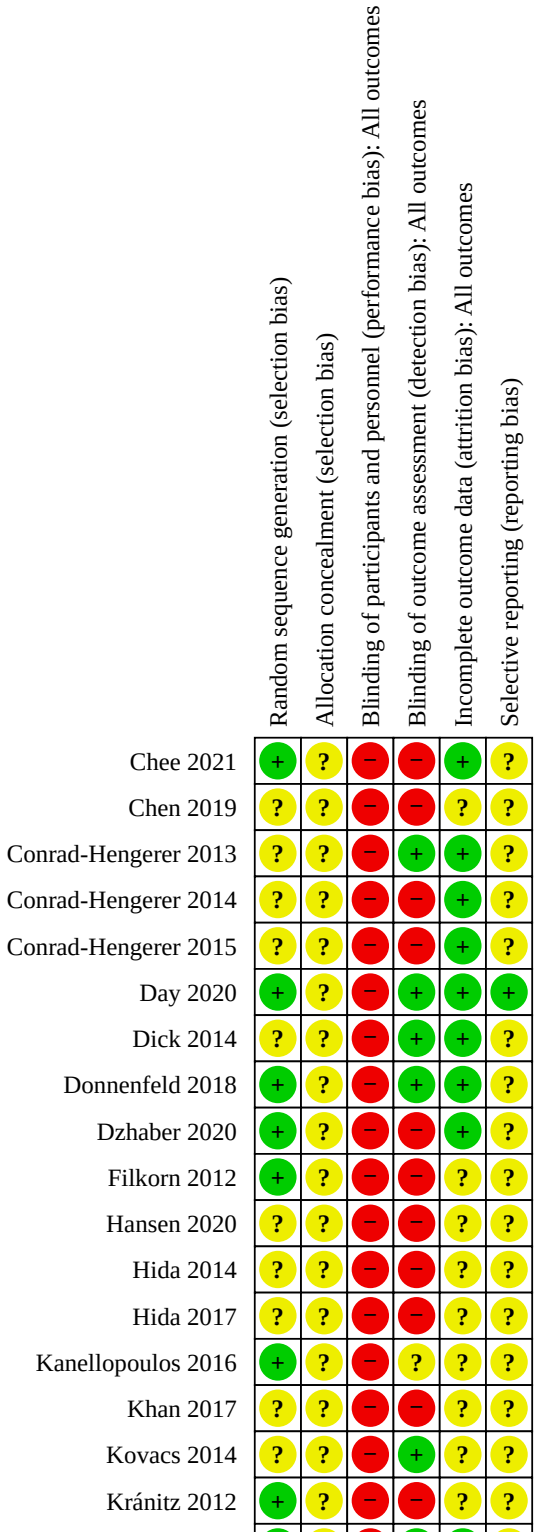
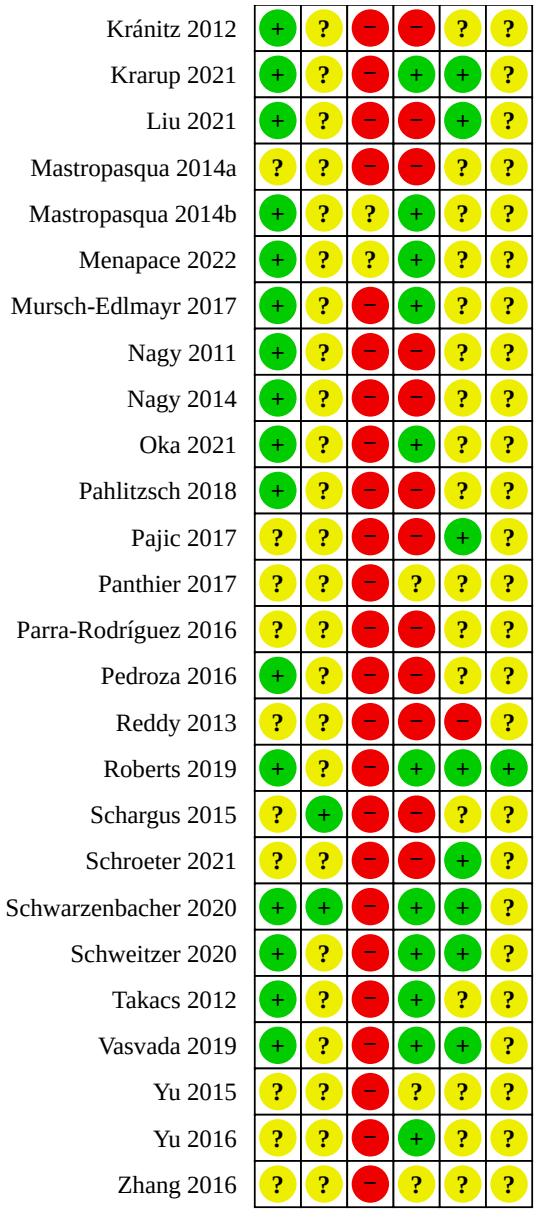


Figure 2. (Continued)



Although all studies were described as randomised, there was variable reporting as to the method of randomised sequence generation used. Fifteen studies report that randomisation was done using "computer-generated tables" or a "computer randomisation chart" (Chee 2021; Day 2020; Donnenfeld 2018; Dzhaber 2020; Filkorn 2012; Kránitz 2012; Liu 2021; Menapace 2022; Nagy 2011; Nagy 2014; Pahlitzsch 2018; Roberts 2019; Schwarzenbacher 2020; Takacs 2012; Vasvada 2019). Five studies used balanced block randomisation (Krarup 2021; Mursch-Edlmayr 2017; Oka 2021; Pedroza 2016; Schweitzer 2020). Kanellopoulos 2016 used randomisation tables. At best, Mastropasqua 2014b state a "computer-generated, 6-block, 15-patient randomisation list was generated using an in-house closed-source software developed in MATLAB" (MATLAB 2009). Patients were assigned to "1 of the 3 treatments with an equal probability for each group." The other studies did not describe the method of sequence generation and we judged them at unclear risk of bias.

The methods of allocation concealment were insufficiently or not described in all but two studies. In Schargus 2015, the enclosed assignments were inserted into sequentially numbered, opaque, well-sealed envelopes for allocation concealment, which were continuously monitored. Investigators ensured that the envelopes were opened sequentially and only after the participant's name and other details were written on the appropriate envelope. In Schwarzenbacher 2020, sequentially numbered, sealed envelopes (provided by an investigator with no clinical involvement in the trial) were opened by the surgeon on the day of surgery. We judged both of these studies to be at low risk of allocation concealment bias. The studies Conrad-Hengerer 2013, Conrad-Hengerer 2014, Conrad-Hengerer 2015, Day 2020,

Dick 2014 and Menapace 2022 used physical or computer-based "envelopes" for allocation concealment and "the surgeon opened the corresponding envelope" at the time of surgery. As no further details about the allocation concealment methodology were given (e.g. use of sequentially numbered envelopes), we judged these studies to be at unclear risk of bias. Oka 2021 reported that randomisation information was masked to the specular microscope observer other than the surgeon. As no further details about the allocation concealment methodology were given (e.g. use of sequentially numbered envelopes), we judged these studies to be at unclear risk of bias. None of the other trials gave details on the methods of allocation concealment used, and we judged them to be at unclear risk of bias.

Blinding

Surgeon masking was not possible and in general participant masking was not described, so we judged most studies to be at high risk for performance bias. In Schweitzer 2020, participants were masked to the surgical treatment allocation until the last follow-up visit at 12 months after surgery, and a sham laser procedure was set up in the operating room for participants randomly assigned to the manual phacoemulsification arm. In Mastropasqua 2014b, "The patients were masked to group assignment until the study was completed", however it was unclear how the participants could remain masked unless sham laser was performed, and there was no description of this, so we judged this to be unclear risk of bias. Reddy 2013 was described as open-label and was definitely not masked, so we judged it to be at high risk of both performance and detection bias. In Schwarzenbacher 2020 and Menapace 2022, "The patients and investigators were masked to the surgery", however it was unclear how the participants could remain masked unless sham laser was performed, and there was no description of this, so we judged these to be at high risk of bias

Masking of any outcome assessment was described in 19 studies. In the studies Conrad-Hengerer 2013 and Dick 2014, a masked technician performed the "full clinical examination" and "all slit-lamp measurements", respectively, following surgery. In Mastropasqua 2014b, the "examiners performing preoperative and postoperative assessments were masked to group assignment until the study was completed." In Takacs 2012 and Mursch-Edlmayr 2017, postoperative examinations were masked. In Kovacs 2014, masking of posterior capsule opacification measurement only is described (study primary outcome). In Donnenfeld 2018, the ophthalmologist performing the wound evaluations was not the operating surgeon and was masked to all incision types. In Roberts 2019, visual acuity and any investigations were performed by optometrists or technicians masked to the participant's treatment arm. In Vasvada 2019, a single masked observer recorded all the observations at each postoperative visit. In Schweitzer 2020, all medical and non-medical staff involved in the study were specifically trained in the participant randomisation and masking processes from the screening visit up to the last follow-up visit, including on the day of surgery in the operating room and in the ambulatory surgery setting. All outcome assessors and the trained technicians who examined patients were also masked to the surgical treatment allocation. An independent adjudication committee composed of three independent expert ophthalmologists, who were masked to randomisation and patient clinical examination during follow-up, analysed all adverse events related to the primary outcome measures. In Day 2020, all trial follow-ups were performed by an optometrist masked to the trial intervention.

For Yu 2015, only capsulorhexis size was measured by a masked examiner, but masking of other outcomes was not described. In Yu 2016, outcome assessments were masked.

In Schwarzenbacher 2020, one masked investigator performed experiments on all samples of aqueous humour.

In Krarup 2021, all postoperative measurements were performed by the same optometrists who were blinded to operation method.

For Oka 2021, only endothelial cell count was measured by a masked examiner, but masking of other outcomes was not described.

For Menapace 2022, the examiner was masked to the type of surgery offered to the patient but does not state which specific outcomes they were examining.

In Kanellopoulos 2016, it is stated that "Optometry staff collected data during the scheduled patient visits, not aware, at the time of data collection, of the potential future use of these data for the purpose of the present analysis." In Panthier 2017, it is stated for capsulotomy parameters that these were "analysed by a single operator, ignoring the surgical procedure." For both of these studies, the description was not consistent with that expected for masked outcome assessment.

No masking of outcome assessment was described in the other included studies.

Incomplete outcome data

There was variable reporting of data attrition with only 24 of the 42 included studies providing any detail.

In Conrad-Hengerer 2013, 2/75 participants (4/150 eyes) were excluded at the three-month follow-up (one due to poor health - cancer - and one had moved abroad). Conrad-Hengerer 2014 and Conrad-Hengerer 2015 state that 102/104 and 196/200 eyes, respectively, were included and analysed at six months postoperatively. In Dick 2014, "all patients were included in the 3-month follow-up." For Mastropasqua 2014a, based on the number of eyes reported in Figure 1, there was no loss to follow-up. In Mastropasqua 2014b, based on the results ("Each group comprised 30 eyes (30 patients)"), there was no loss to follow-up. In Filkorn 2012, the number of participants at baseline was the same as those with postoperative data. In Pajic 2017, the number of participants at baseline was the same as those with postoperative data. In Donnenfeld 2018, the number of participants at baseline was the same as those with postoperative data. In Roberts 2019, the high overall rate of follow-up of 97.8% suggests that possible biases resulting from unequal follow-up are unlikely to be important and there was no significant difference in the characteristics of patients who attended the 12-month follow-up and those who were lost to follow-up. In Vasvada 2019, the number of participants at baseline was the same as those with postoperative data. In Dzhaber 2020, 10 participants were later excluded. Of those, two participants had PCS in both eyes (inability to perform FLACS due to anatomical features) and another two had FLACS in both eyes (due to patient's preference after having FLACS in the first eye). Six patients missed their three-month follow-up visit. In Schweitzer 2020, all losses

to follow-up were accounted for. In Day 2020, participants who did not attend were contacted by identical methods to rebook within trial timescales, and an additional sensitivity analysis does not suggest a difference in the characteristics of those who were lost to follow-up. In Schwarzenbacher 2020, all the samples to be analysed were collected five minutes after the procedure for all participants, so none of the participants were lost to follow-up. In Chee 2021, the number of participants at baseline was the same as those with postoperative data. In Krarup 2021, three patients were excluded from the final analysis (two participants experienced complications and one was unable to co-operate for the laser). In Liu 2021, four participants were lost to follow-up and three participants developed postoperative complications that required them to be excluded; these were accounted for in the final analysis. In Oka 2021, two participants were excluded from the final analysis as their surgery was not performed according to the randomisation table. In Schroeter 2021, four participants were excluded from the study, as they did not show up for all postoperative examinations. In Menapace 2022, eight participants were excluded from the final analysis as they did not complete follow-up. We assessed these 21 studies to be at low risk of bias.

A total of 14/131 participants were excluded in Reddy 2013. One eye in the FLACS group was excluded from analysis because of a protocol violation (no details of this are given). Seven eyes in the FLACS group and four in the PCS group were also excluded from further analysis with the reason for this being described as "to guarantee correct data analysis and rule out preoperative bias" by ensuring "equal cataract grade distributions in the 2 study groups" were present. We judged this study to be at high risk of bias.

Kanellopoulos 2016 had no loss to follow-up of their 66 participants at three months, and report inconsistent numbers at six months (60/66, 62/66) and one year (59/66 and 58/66). No reasons for loss to follow-up are described.

In Mursch-Edlmayr 2017, three participants (six eyes) from their total of 50 participants were lost to follow-up. No reasons for loss to follow-up are given.

Selective reporting

All studies reported prespecified outcome measures in their methodology, however it was unclear whether these were truly prespecified, as the study protocol was not available and the trials were not registered on a clinical trials' database (except for Yu 2016). It was unclear if the statistical analysis methods were prespecified and, therefore, although none of the included studies appeared to demonstrate selective reporting, we judged all to be at unclear risk of bias. In Yu 2016, the registration on clinicaltrials.gov states that 54 enrolled (unclear whether eyes or participants), however the paper only reports data on 39 eyes of 20 participants. Roberts 2019 and Day 2020 were judged to be at low risk of reporting bias as the outcomes of interest were reported in the prespecified way in both the protocol and in the published report.

Other potential sources of bias

All the main sources of bias that we encountered in the studies have been reflected in the aforementioned categories.

Effects of interventions

See: **Summary of findings 1** Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery

Intraoperative complications in the study eye (primary outcome)

There was variable reporting of types and detail regarding intraoperative complications between studies.

See Analysis 1.1.

Anterior capsule tears

There was low-certainty evidence of little or no difference in the odds of developing anterior capsular tears when comparing femtosecond laser-assisted cataract surgery (FLACS) and phacoemulsification cataract surgery (PCS) (Peto odds ratio (OR) 0.83, 95% confidence interval (CI) 0.40 to 1.72). There was one fewer anterior capsule tear per 1000 operations in the FLACS group compared with the PCS group (95% CI 4 fewer to 3 more; 5835 eyes, 27 studies).

Overall, the number of anterior capsule tears reported in the individual studies was low. There were 10 studies that reported one or more events in one or both arms. Eighteen studies reported no events or were assumed to report no events as they described other intraoperative complications but not anterior capsular tears. In six studies, participants with intraoperative complications were excluded and therefore not reported. As these six studies did not provide details on the numbers of participants with intraoperative complications that were included, we judged them to be at unclear risk of attrition bias. Nine studies did not provide any data on intraoperative complications.

Given that anterior capsular tears, like all intraoperative and postoperative complications, were rare events, we used the Peto odds ratio as the method of analysis for all intraoperative and postoperative complications. Although the estimates of effect in the 10 studies contributing events were different (0.14, 7.39, 1.49, 7.39, 0.15, 7.39, 1.13, 1.97, 0.13, 0.14), it is likely that these are chance fluctuations due to the low number of events (I^2 = 0%), therefore we have pooled the data for this outcome (Analysis 1.1).

We graded this evidence as moderate-certainty, downgrading for risk of bias because studies were poorly reported and we largely judged them to be at unclear or high risk of bias. We also downgraded for imprecision because of the large sample size and low number of events (Summary of findings 1).

Posterior capsule tears

See Analysis 1.2.

There was low-certainty evidence of FLACS carrying a lower odds of developing posterior capsular tears compared to PCS (Peto OR 0.50, 95% CI 0.25 to 1.00). There were four fewer posterior capsule tears per 1000 operations in the FLACS group compared with the PCS group (95% CI 6 fewer to same; 5767 eyes, 26 studies).

Overall, the number of posterior capsule tears reported in the studies was low. There were five studies that reported one or more events in one or both arms. Twenty-two studies reported or were assumed to report, when they described

other intraoperative complications but not posterior capsular tears specifically, no events. In six studies, participants with intraoperative complications were excluded and therefore not reported. As these six studies did not provide details on the numbers of participants with intraoperative complications that were included, we judged these six studies to be at unclear risk of attrition bias. Nine studies did not provide any data on intraoperative complications.

Although the estimates of effect in the five studies contributing events were different (0.13, 0.56, 0.13, 0.14, 0.88), it is likely that these are chance fluctuations due to the low number of events (I^2 = 0%), therefore we have pooled the data for this outcome (Analysis 1.2).

We graded this evidence as low certainty, downgrading for risk of bias because studies were poorly reported and we largely judged them to be at unclear or high risk of bias. We also downgraded for imprecision because of the large sample size and low number of events (Summary of findings 1).

Distance visual acuity in the operated eye at least one month after cataract surgery

Twenty-six studies reported data on postoperative visual acuity, with 12 studies reporting data on both corrected distance visual acuity (CDVA) and uncorrected distance visual acuity (UDVA) outcomes, 13 studies reporting data on CDVA outcomes only and one study reporting data on UDVA outcomes only.

Corrected distance visual acuity

Twenty-five studies reported data on CDVA outcomes.

CDVA was reported at the following time periods postoperatively:

- one day: six studies (Hansen 2020; Krarup 2021; Mursch-Edlmayr 2017; Pajic 2017; Schroeter 2021; Yu 2015);
- one week: five studies (Hansen 2020; Kránitz 2012; Mastropasqua 2014b; Vasvada 2019; Yu 2015);
- one month: 13 studies (Chee 2021; Donnenfeld 2018; Hansen 2020; Kránitz 2012; Krarup 2021; Liu 2021; Mastropasqua 2014a; Mastropasqua 2014b; Mursch-Edlmayr 2017; Pajic 2017; Schroeter 2021; Vasvada 2019; Yu 2015);
- two months: two studies (Pajic 2017; Schroeter 2021);
- three months: 10 studies (Day 2020; Hansen 2020; Liu 2021; Mursch-Edlmayr 2017; Pajic 2017; Schroeter 2021; Schweitzer 2020; Vasvada 2019; Yu 2015; Zhang 2016);
- six months: seven studies (Krarup 2021; Liu 2021; Mastropasqua 2014a; Mastropasqua 2014b; Mursch-Edlmayr 2017; Oka 2021; Schargus 2015);
- one year: five studies (Day 2020; Kránitz 2012; Liu 2021; Panthier 2017; Roberts 2019).

CDVA data from Kránitz 2012, Mursch-Edlmayr 2017, Pahlitzsch 2018 and Zhang 2016 were not included in the meta-analysis due to visual acuity data being reported in Snellen rather than logMAR. Whilst conversion of mean Snellen values to logMAR is possible, conversion of standard deviations (SDs) is not. CDVA data from Pajic 2017 were not included in the meta-analysis due to visual acuity data being reported with ranges rather than standard deviations.

One week

At one-week follow-up, the mean difference in CDVA ranged from -0.12 logMAR in favour of FLACS to 0.02 logMAR in favour of PCS (Analysis 1.3). There was substantial heterogeneity in these studies (I^2 = 69%). Given that the differences between studies may be clinically important, we decided not to pool the data as the pooled effect measure may not be informative.

As the estimate provided by Yu 2015 was an outlier in this analysis, we conducted a sensitivity analysis excluding the study. This analysis did not materially change the effect estimates for this outcome measure.

One to three months

At one to three months follow-up, there was little or no difference in visual acuity when comparing FLACS and PCS (MD -0.00 logMAR, 95% CI -0.01 to 0.01, 2791 eyes, 11 studies, I^2 = 21%) (Analysis 1.4).

As the estimate provided by Yu 2015 was an outlier in this analysis, we conducted a sensitivity analysis excluding the study. This analysis did not materially change the effect estimates for this outcome measure.

Six months or more

At six months or more follow-up, there was moderate-certainty evidence of a very small advantage for the FLACS arm (MD -0.01 logMAR, 95% CI -0.02 to 0.00, 1323 eyes, 7 studies, I^2 = 0%). This difference is equivalent to 1 logMAR letter between groups and is not thought to be clinically important (Analysis 1.5; Summary of findings 1).

Uncorrected distance visual acuity

Thirteen studies reported data on UDVA outcomes (Conrad-Hengerer 2015; Day 2020; Donnenfeld 2018; Hansen 2020; Kránitz 2012; Liu 2021; Mastropasqua 2014a; Mastropasqua 2014b; Panthier 2017; Roberts 2019; Schweitzer 2020; Vasvada 2019; Zhang 2016).

UDVA was reported at the following time periods postoperatively:

- one day: two studies (Hansen 2020; Liu 2021);
- one week: five studies (Hansen 2020; Kránitz 2012; Liu 2021; Mastropasqua 2014b; Vasvada 2019);
- one month: eight studies (Donnenfeld 2018; Hansen 2020; Kránitz 2012; Liu 2021; Mastropasqua 2014a; Mastropasqua 2014b; Roberts 2019; Vasvada 2019);
- three months: six studies (Day 2020; Hansen 2020; Liu 2021; Schweitzer 2020; Vasvada 2019; Zhang 2016);
- six months: four studies (Conrad-Hengerer 2015; Liu 2021; Mastropasqua 2014a; Mastropasqua 2014b);
- one year: five studies (Day 2020; Kránitz 2012; Liu 2021; Panthier 2017; Roberts 2019).

UDVA data from Zhang 2016 were not included in the meta-analysis due to visual acuity data being reported in Snellen rather than logMAR. Whilst conversion of mean Snellen values to logMAR is possible, conversion of SDs is not.

One week

At one-week follow-up, the mean difference in UDVA ranged from -0.10 logMAR in favour of FLACS to 0.06 logMAR in favour of PCS (Analysis 1.6). There was substantial heterogeneity between studies (I^2 = 89%). Given that the range of UDVA at one week postoperatively is clinically important, we decided not to pool the data as the pooled effect measure may not be informative.

As the estimate provided by Mastropasqua 2014b was an outlier in this analysis, we conducted a sensitivity analysis excluding the study. This analysis did not materially change the effect estimates for this outcome measure.

One to three months

At one to three months follow-up, the difference in UDVA ranged from -0.11 logMAR in favour of FLACS to 0.07 logMAR in favour of PCS (Analysis 1.4). With an I^2 value of 75%, there is substantial heterogeneity in these studies. Given that the range of UDVA at one to three months postoperatively is clinically important, we decided not to pool the data as the pooled effect measure may not be informative.

As the estimate provided by Mastropasqua 2014b was an outlier in this analysis, we conducted a sensitivity analysis excluding the study. This analysis did not materially change the effect estimates for this outcome measure.

Six months or more

At six months or more follow-up, the mean difference in UDVA ranged from -0.15 logMAR in favour of FLACS to 0.05 logMAR in favour of PCS. With an I^2 value of 94%, there is substantial heterogeneity in these studies. Given that the range of UDVA at six months or more postoperatively is clinically important, we decided not to pool the data as the pooled effect measure may not be informative.

As the estimate provided by Mastropasqua 2014b was an outlier in this analysis, we conducted a sensitivity analysis excluding the study. This analysis did not materially change the effect estimates for this outcome measure.

Patient-reported outcome measures (PROMs) at least one month after cataract surgery

Study	PROM measures	Time point	FLACS			PCS			Mean difference (95% CI), if reported	P value, if reported
			Number of participants followed up	Mean/median	SD	Number of participants followed up	Mean/median	SD or IQ range		
Roberts 2019	Cat-PROM5	1 month	200	-2.44 (mean)	3.13	200	-2.22	2.89	—	0.49
	EQ-5D			0.03 (mean)	0.17		0.03	0.16	—	1
Day 2020	Catquest9-SF	3 months	353	2.30 (mean)	1.31	317	2.27	1.30	0.07 (0.13 to 0.28)	0.49
	EQ-5D-3L			0.84 (mean)	0.23		0.82	0.25	0.0002 (-0.03 to 0.03)	0.88
Hansen 2020	Patient survey	3 months	64	—	—	71	—	—	—	0.312

Only three studies reported patient-reported outcome measures (PROMS) after surgery (Day 2020; Hansen 2020; Roberts 2019).

In Roberts 2019, PROMs were analysed by measuring quality of life with the EQ-5D, a EuroQOL five dimensions questionnaire, and patient-reported quality of vision with the Cat-PROM5, a cataract surgery PROMs questionnaire, at one month after surgery. The Cat-PROM5 demonstrated a substantial shift between preoperative to postoperative completions in the two intervention groups. The EQ-5D summary index similarly reflected an improved score that was similar in the two groups. At 12 months after surgery, the PROMs indices were similar across both groups.

In Day 2020, health-related quality of life was measured with the EQ-5D-3L questionnaire and vision bolt-on questionnaire (EQ-5DV) at six weeks and three months, and patient-reported vision health status was measured using the Catquest9-SF, a Rasch validated instrument at six weeks and three months. They found no difference between arms for health-related quality of life as measured by the EQ-5D-3L questionnaire and vision bolt-on questionnaire (EQ-5DV), or patient-reported vision status using the Catquest9-SF, a Rasch-validated instrument.

In Hansen 2020, participants were asked to complete surveys at postoperative day one, postoperative month one and postoperative month three. Overall, participants reported excellent or good overall experience in both groups and were generally satisfied with the length of either procedure. Marginally more participants reported discomfort with FLACS than PCS. Patients' satisfaction with the quality of vision and satisfaction with their ability to perform their daily activities were similar.

We judged this to be moderate-certainty evidence. We downgraded the evidence by one level for risk of bias because studies were poorly reported and largely judged to be at unclear or high risk of bias.

Postoperative or long-term complications reported within one year of cataract surgery

Cystoid macular oedema

There was low-certainty evidence of little or no difference in the odds of developing cystoid macular oedema when comparing FLACS and PCS (Peto OR 0.84, 95% CI 0.56 to 1.28) (Analysis 1.9; Summary of findings 1). There were three fewer cystoid macular oedema cases per 1000 operations in the FLACS group compared with the PCS group (95% CI 10 fewer to 6 more; 4441 eyes, 18 studies).

Overall, the number of cystoid macular oedema cases reported in studies was low. There were 11 studies that reported one or more events in one or both arms. Seven studies reported, or were assumed to report when they described other postoperative complications but not cystoid macular oedema specifically, no events. In six studies, participants with postoperative complications were excluded and therefore not reported. As these six studies did not provide details on the numbers of participants with intraoperative complications that were included, we judged these six studies to be at unclear risk of attrition bias. Eighteen studies did not provide any data on postoperative complications.

Although the estimates of effect in the 11 studies contributing events were different (1.00, 0.66, 0.66, 0.49, 1.14, 3.38, 0.49, 3.06, 1.34, 0.32, 0.75), it is likely that these are chance fluctuations due to the low number of events(I^2 = 0%), therefore we have pooled the data for this outcome.

We graded this evidence as low-certainty, downgrading for risk of bias as studies were poorly reported and we largely judged them to be at unclear or high risk of bias. We also downgraded for imprecision because of the large sample size and low number of events (Summary of findings 1).

Raised intraocular pressure

Nine studies specifically reported raised intraocular pressure in the postoperative period and seven of these gave data at specified time points (Chen 2019; Conrad-Hengerer 2013; Conrad-Hengerer 2014; Conrad-Hengerer 2015; Day 2020; Roberts 2019; Schargus 2015) (Analysis 1.9).

Yu 2015 reported that one eye (1/29) in the PCS arm had steroid response ocular hypertension and none (0/25) in the FLACS arm. They do not describe the time after surgery at which this occurred and so these data have not been included in Analysis 1.9. Pedroza 2016 found that intraocular pressure was similar across both arms, but do not report whether any participants had elevated intraocular pressure. In Schargus 2015, it must be noted that no ophthalmic viscosurgical device was used in the FLACS arm but was in the standard phacoemulsification arm. Additionally, those in the standard phacoemulsification arm were given oral acetazolamide for intraocular pressure prophylaxis, whilst those in the FLACS arm were not.

In Roberts 2019, there were 2/200 eyes with raised intraocular pressure in the FLACS arm compared to 0/200 in the PCS arm at one month postoperatively. Since the participants were reviewed at four weeks, the postoperative intraocular pressure rises might have gone unnoticed. In Chen 2019, raised intraocular pressure was only observed in one eye in the FLACS arm and four eyes in the PCS arm one month after surgery. In Day 2020, 4/391 in the FLACS arm and 3/389 in the PCS arm had steroid response ocular hypertension (three months follow-up). Zhang 2016 states that there were no cases of elevated intraocular pressure in either arm.

In four studies, it is stated that there were no postoperative complications, and thus it is assumed there were no cases of elevated intraocular pressure (Kovacs 2014; Kránitz 2012; Nagy 2011; Nagy 2014). In Khan 2017, Mastropasqua 2014a and Mastropasqua 2014b, complications were excluded and therefore not reported. Twelve studies did not provide data on complications (Dick 2014; Filkorn 2012; Hida 2014; Kanellopoulos 2016; Menapace 2022; Panthier 2017; Parra-Rodríguez 2016; Pedroza 2016; Schroeter 2021; Takacs 2012; Vasvada 2019; Yu 2016). Mursch-Edlmayr 2017 provides some data on other complications, but does not mention raised intraocular pressure, and so we assume there were no cases. Follow-up in Reddy 2013 was limited to one day and "no adverse events were observed." Liu 2021 provides data on cystoid macular oedema postoperatively but does not mention raised intraocular pressure and so we assume there are no cases.

Considering elevated intraocular pressure immediately after surgery, the number of events was low: 2/73, 1/104 and 3/100 eyes in the FLACS arms of Conrad-Hengerer 2013, Conrad-Hengerer 2014, Schargus 2015 and Conrad-Hengerer 2015, respectively;

compared to 2/73, 2/104, 1/37 and 2/100 for the PCS arms: OR 0.86, 95% CI 0.29 to 2.56; 1116 eyes, 10 studies (Analysis 1.9).

Considering elevated intraocular pressure reported between one day and one week postoperatively, the number of events was low: 1/73, 0/104, 1/37 and 0/100 eyes in the FLACS arms of Conrad-Hengerer 2013, Conrad-Hengerer 2014, Schargus 2015 and Conrad-Hengerer 2015, respectively; compared to 0/73, 1/104, 3/37 and 0/100 for the PCS arms: OR 0.50, 95% CI 0.10 to 2.55; 1411 eyes, 11 studies (Analysis 1.9).

Posterior capsule opacification

Only six studies reported posterior capsule opacification rates (Day 2020; Kovacs 2014; Liu 2021; Oka 2021; Roberts 2019; Yu 2015).

In Yu 2015, 2/29 eyes in the control PCS arm required YAG laser posterior capsulotomy at one and three months, respectively, following surgery. No eyes (0/25) in the FLACS arm required YAG capsulotomy.

Kovacs 2014 investigated posterior capsule opacification development between arms for between 18 and 26 months postoperatively. They found higher posterior capsule opacification scores in the PCS arm, however no participants in either arm required YAG laser posterior capsulotomy (0/39 PCS arm, 0/40 FLACS arm).

In Roberts 2019, 2/118 eyes in the control PCS arm developed posterior capsule opacification and required YAG laser posterior capsulotomy, and 2/116 eyes in the FLACS arm developed posterior capsule opacification and required YAG laser posterior capsulotomy.

In Day 2020, 6/389 eyes in the control PCS arm developed posterior capsule opacification and required YAG laser posterior capsulotomy, and 4/391 eyes in the FLACS arm developed posterior capsule opacification and required YAG laser posterior capsulotomy.

In Liu 2021, 4/78 eyes in the control PCS arm developed posterior capsule opacification and 5/78 eyes in the FLACS arm developed posterior capsule opacification.

In Oka 2021, 1/55 eyes in the control PCS arm developed posterior capsule opacification and 1/55 eyes in the FLACS arm developed posterior capsule opacification.

Overall the pooled OR was 0.81 (95% CI 0.38 to 1.73) (Analysis 1.9).

Other complications

Chee 2021 reports rates of postoperative corneal oedema on day one and week one postoperatively, with no difference found between arms. Mursch-Edlmayr 2017 reports rates of postoperative Descemet membrane folds on day one, with no difference found between arms. Zhang 2016 reported postoperative Descemet membrane folds in 5/153 FLACS cases compared to 20/161 of PCS cases. Roberts 2019 reported similar rates of corneal oedema, prolonged anterior uveitis, vitreous in anterior chamber, suture abscess, hypotony and suprachoroidal haemorrhage across both arms. Chen 2019 reported lower rates of corneal oedema in FLACS cases (2/47 versus 4/47). Schweitzer 2020 reported higher rates of corneal oedema in laser cases (6/704 versus 1/685, P value non-significant). Oka 2021 reported similar rates of ciliary zonular dehiscence, conjunctivochalasis, conjunctival haemorrhage, hordeolum and vitreous prolapse across both arms.

Roberts 2019 reported rates of wet age-related macular degeneration, vitreomacular traction, anterior capsule phimosis and sulcus intraocular lens.

Day 2020 reported 8/391 FLACS cases with corneal oedema and 2/398 for the PCS arm at one year. Day 2020 also reported similar rates of zonular dialysis, intraoperative pupil constriction, dropped lens fragments and suprachoroidal haemorrhage, postoperative anterior uveitis, retinal tear/detachment, medication allergy/intolerance, corneal oedema and posterior vitreous detachment across both arms.

Mursch-Edlmayr 2017 also reports one case of choroidal effusion one day postoperatively in a laser participant that required oral prednisolone for five days for resolution.

Chen 2019 also reports one case of retinal detachment two months after surgery in a standard phacoemulsification participant that was successfully reset after receiving conservative treatment.

Corneal endothelial cell counts

Twenty-one studies reported data on endothelial cell counts (Chee 2021; Conrad-Hengerer 2013; Day 2020; Hansen 2020; Hida 2017; Kanellopoulos 2016; Khan 2017; Krarup 2021; Liu 2021; Mursch-Edlmayr 2017; Oka 2021; Parra-Rodríguez 2016; Pedroza 2016; Roberts 2019; Schargus 2015; Schroeter 2021; Schweitzer 2020; Takacs 2012; Vasvada 2019; Yu 2015; Zhang 2016).

Corneal endothelial cell counts were reported as change (loss) or final value. As some studies reported both measures, we have done separate analyses for these. Analysis 1.10 presents data on endothelial cell loss and Analysis 1.11 presents data on the absolute postoperative endothelial cell count following surgery for studies with one or more months postoperative follow-up.

Parra-Rodríguez 2016 report data at one, three and six months postoperatively. Due to how the data were presented, this could not be included in the meta-analysis (Analysis 1.11).

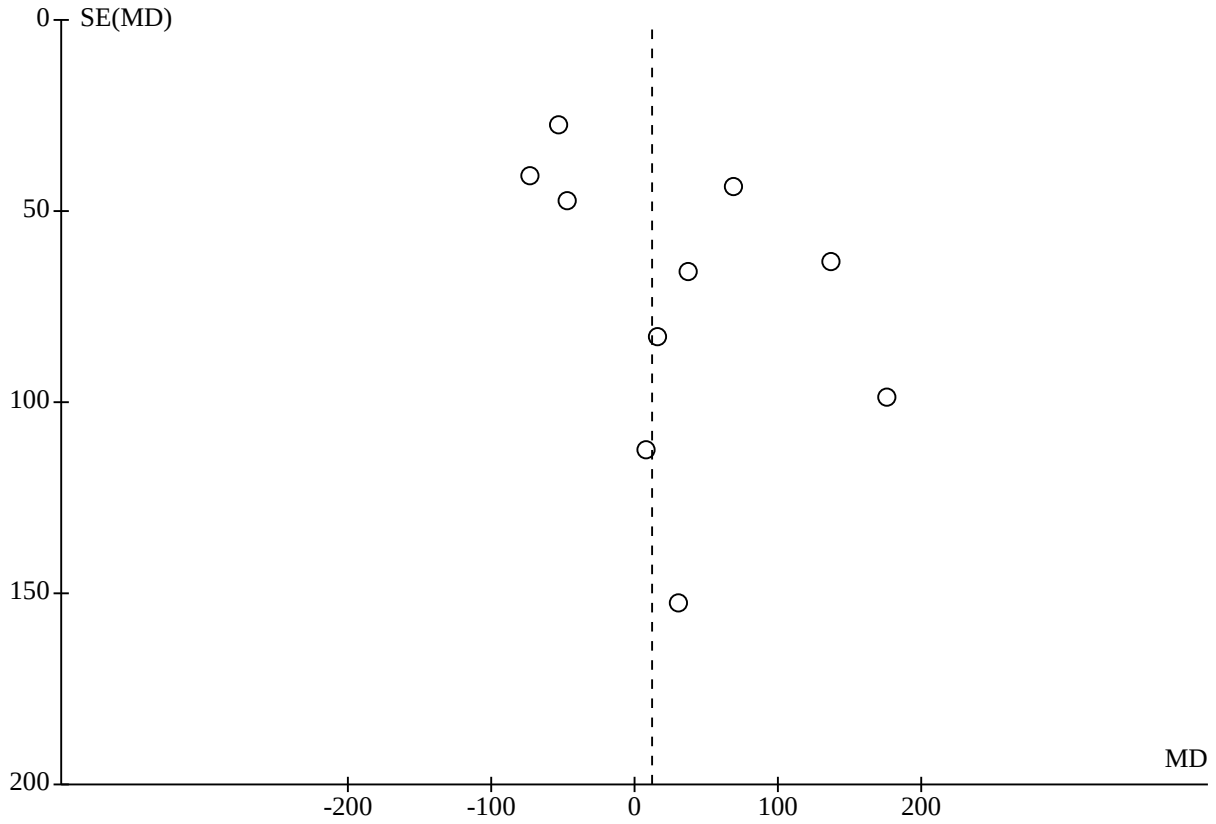
Pedroza 2016 reported endothelial cell count data with up to one month follow-up. They found no difference in endothelial cell count between groups. Due to how the data were presented, this could not be included in the meta-analysis (Analysis 1.11).

Zhang 2016 reported corneal endothelium loss at one month postoperatively in FLACS cases. Due to how the data were presented, this could not be included in the meta-analysis (Analysis 1.11).

Overall, there was low-certainty evidence of little or no important difference in endothelial cell loss when comparing FLACS with PCS (MD 12 cells per mm^2 in favour of FLACS, 95% CI -40 to 64; 1512 eyes, 10 studies) (Analysis 1.10; Summary of findings 1). There was some evidence of heterogeneity (I^2 = 51%), but given this was borderline for our decision to pool or not we present a summary estimate and have downgraded for inconsistency in the GRADE judgement, leading to low-certainty evidence (also downgraded for risk of bias as studies were poorly reported and we largely judged them to be at unclear or high risk of bias). There was some suggestion of different effects in small studies, which could be interpreted as

publication bias (Figure 3), but this was not conclusive and we did not additionally downgrade for this.

Figure 3.



At final follow-up, there was little or no difference in the absolute postoperative endothelial cell counts in both arms (MD 24.18, 95% CI -20.06 to 68.43, 1836 eyes, 12 studies, I^2 = 21%) (Analysis 1.11).

Costs and resource use

Data on costs were reported by Day 2020 and Schweitzer 2020.

Day 2020 reported on health, social care or societal costs for both FLACS and PCS. For the economic evaluation, the mean cost difference (FLACS minus PCS) for the imputed, bootstrapped, adjusted data was GBP £167.62 per participant (95% of iterations between –£14.12 and £341.67). The mean quality-adjusted life year (QALY) difference (FLACS minus PCS) was 0.001 (95% of iterations between –0.011 and 0.015). This equates to an incremental cost-effectiveness ratio (cost difference divided by QALY difference) of £167,620.

Schweitzer 2020 found the mean costs of the cataract surgeries estimated by microcosting were EUR €1119.7 (SD 162.2) for FLACS and €565.5 (SD 61.4) for PCS. The mean inpatient and outpatient costs obtained from the French National Health Data System were €3418.6 (1868.4) for patients treated with FLACS and €3667.5 (3775.1) in patients treated with PCS. After multiple imputation of missing data and adding the microcosting between-group difference as a constant to the costs in the FLACS group, the total mean cost of care was €3975.5 (1754.3) for patients treated with FLACS and €3670.2 (3673.5) in patients treated with PCS. The (ICER) incremental cost-effectiveness ratio was €10,703 saved per additional patient who had treatment success with PCS compared to FLACS.

Based on the 11 studies reporting data on the duration of the procedure, this ranged from three minutes in favour of FLACS to eight minutes in favour of PCS. Duration of the procedure only refers to total operating time and does not include the time taken to transfer the patient from the laser. With an I^2 value of 100%, there is substantial heterogeneity in these studies. Given that the range of duration of the procedure is clinically important, we decided not to pool the data as the pooled effect measure may not be informative. One additional study did report procedure duration but did state similar surgery times between arms (Conrad-Hengerer 2014).

We judged this to be low-certainty evidence. We downgraded the evidence by one level for risk of bias because studies were poorly reported and largely judged to be at unclear or high risk of bias, and we downgraded a further level for inconsistency as different results were seen in different studies.

Refractive outcomes

Twelve studies reported data on refractive outcomes (Conrad-Hengerer 2015; Day 2020; Filkorn 2012; Hida 2014; Kanellopoulos 2016; Liu 2021; Mastropasqua 2014b; Panthier 2017; Roberts 2019;

Schroeter 2021; Schweitzer 2020; Yu 2015). There were differences in how the refractive results were reported between studies, which limited comparisons between trial arms.

Filkorn 2012 reported that the achieved postoperative spherical equivalents were -0.50 dioptres (D) (SD 1.06) and -0.58 D (1.28) for FLACS and PCS arms respectively. Mean errors were -0.03 D (0.47) and 0.07 D (0.63) for FLACS and PCS arms, respectively. Mean absolute errors (MAE, mean of the individual prediction errors without regard for its sign) were 0.38 D (0.28) and 0.50 D (0.38) for FLACS and PCS arms, respectively. In the FLACS arm, 42% of eyes were within ± 0.25 D of target refraction compared to 28% in the PCS arm. In the FLACS arm, 69% of eyes were within ± 0.50 D of target refraction compared to 65% in the PCS arm. In the FLACS arm, 99% of eyes were within ± 1.0 D of target refraction compared to 88% in the PCS arm. These data were "measured 6 to 12 weeks after surgery".

Hida 2014 reported that the mean predicted and achieved postoperative spherical equivalents were -0.30 D (SD 0.39) and -0.16 D (0.38) for the FLACS arm. For the PCS arm these were +0.33 D (SD 0.33) and -0.03 D (0.28). Data on mean absolute errors were not reported, or proportions within ± 0.50 or ± 1.0 dioptres target refraction were not reported.

Mastropasqua 2014b reported data on postoperative refractive outcomes and found the mean postoperative spherical equivalents at one month to be -0.25 D (0.38), -0.23 (0.64) and -0.39 (0.33) in FLACS arms 1 and 2, and the PCS arm, respectively. The mean postoperative spherical equivalents at six months were -0.25 D (0.54), -0.26 (0.40) and -0.41 (0.39) in FLACS arms 1 and 2, and the PCS arm, respectively. Mean absolute errors were 0.42 (0.16), 0.36 (0.36) and 0.54 (0.43) in FLACS arms 1 and 2, and the PCS arm, respectively, at one month. Mean absolute errors were 0.44 (0.31), 0.43 (0.10) and 0.56 (0.39) in FLACS arms 1 and 2, and the PCS arm, respectively, at six months. Proportions within ± 0.50 or ± 1.0 dioptres target refraction were not reported.

Conrad-Hengerer 2015 reported the postoperative spherical equivalents by various time points. At one month, the postoperative spherical equivalent was -0.05 D (0.28) in the FLACS arm versus -0.18 D (0.54) in the PCS arm, and at six months -0.05 D (0.28) versus -0.11 D (0.55), respectively. Ninety eyes (92%) in the FLACS group and 70 eyes (71%) in the PCS group were within ± 0.50 D of the target refractive outcome and 98 eyes (100%) in both groups were within ± 1.00 D at 6 months postoperatively. Data on mean absolute errors were not reported.

Yu 2015 reported the absolute deviation between the attempted and achieved spherical equivalents at one day, one week, one month and three months postoperatively. At three months postoperatively, they reported an absolute deviation of (0.16 D (0.16) versus 0.74 (0.65), FLACS versus PCS, respectively). Proportions within ± 0.50 or ± 1.0 dioptres target refraction were not reported.

Kanellopoulos 2016 presented data for both arms overall for attempted versus achieved spherical equivalent. For the PCS group 75% were within ± 0.5 D predicted correction versus 81% for the FLACS group (P = 0.87).

Panthier 2017 reported that 79% of FLACS cases and PCS control cases were within ± 0.5 D, 88% of FLACS cases and PCS control cases were within ± 1.0 D predicted refraction.

Roberts 2019 reported the following refractive outcomes at one month postoperatively: refractive mean spherical equivalent error, mean arithmetic spherical equivalent refractive error from target refraction and mean absolute spherical equivalent refractive error from target refraction. The refractive mean spherical equivalent error was -0.14 D (0.60) in the FLACS arm versus -0.12 D (0.60) in the PCS arm. The mean arithmetic spherical equivalent refractive error from target refraction was -0.01 D (0.56) in the FLACS arm versus 0.04 D (0.58) in the PCS arm. The mean absolute spherical equivalent refractive error from target refraction was 0.42 D (0.40) in the FLACS arm versus 0.40 D (0.46) in the PCS arm. At one month postoperatively, 71% and 94% of eyes in the FLACS arm were within 0.50 D and 1.00 D of the intended spherical equivalent, respectively. In the PCS arm, 77% and 95% of eyes were within 0.50 D and 1.00 D of the intended spherical equivalent, respectively. At one month postoperatively, 37% and 74% of eyes in the FLACS arm were within 0.50 D and 1.00 D of the intended refractive cylinder, respectively. In the PCS arm, 30% and 71% of eyes were within 0.50 D and 1.00 D of the intended refractive cylinder, respectively. They also reported the following refractive outcomes at 12 months postoperatively: mean spherical equivalent refraction, mean arithmetic spherical equivalent refractive error from target refraction, mean absolute spherical equivalent refractive error from target refraction, mean spherical equivalent within 0.5 D and 1.0 D of the refractive target and residual refractive cylinder. The mean spherical equivalent refraction was -0.1 D (0.6) in the FLACS arm versus -0.2 D (0.60) in the PCS arm. The mean arithmetic spherical equivalent refractive error from target refraction was 0.1 D (0.5) in the FLACS arm versus 0.1 D (0.6) in the PCS arm. The mean absolute spherical equivalent refractive error from target refraction was 0.4 D (0.4) in the FLACS arm versus 0.4 D (0.5) in the PCS arm. At 12 months postoperatively, 78% and 95% of eyes in the FLACS arm were within 0.50 D and 1.00 D of the intended spherical equivalent, respectively. In the PCS arm, 81% and 96% of eyes were within 0.50 D and 1.00 D of the intended spherical equivalent, respectively. The residual refractive cylinder was -0.8 D (0.5) in the FLACS arm versus -0.9 D (0.5) in the PCS arm. There were no significant differences between the groups for any of the refractive outcomes.

Schweitzer 2020 reported that 80.1% of the FLACS cases and 82.8% of the PCS cases had an absolute manifest refractive error ≤ 0.75 dioptres (P = 0.986). At three months postoperatively, 54.2%, 20.9%, 10.5%, 5.9% and 8.5% of FLACS cases had an absolute error in manifest refraction spherical equivalent of less than 0.25 D, 0.25 to 0.5 D, 0.5 to 0.75 D, 0.75 to 1.0 D and greater than 1.0 D, respectively. In the PCS arm, 57.1%, 20.8%, 8.9%, 6.4% and 6.7% of cases had an absolute error in manifest refraction spherical equivalent of less than 0.25 D, 0.25 to 0.5 D, 0.5 to 0.75 D, 0.75 to 1.0 D and greater than 1.0 D, respectively.

Day 2020 reported that 71% of both arms were within 0.5 D of the refractive target (P = 0.95) and 93% of the FLACS cases and 92% of the PCS cases were within 1.0 D of the refractive target (P = 0.80) at three months. At one year, it was reported that 75% of both arms were within 0.5 D of the refractive target (P = 0.94) and 95% of the FLACS cases and 96% of the PCS cases were within 1.0 D of the refractive target (P = 0.50). In terms of the refractive astigmatism, 51% of the FLACS cases and 46% of the PCS cases were within 0.5

D of the refractive target; 79% of the FLACS cases and 77% of the PCS cases were within 1.0 D of the intended refractive astigmatism.

Liu 2021 reported the manifest refraction spherical equivalent (MRSE) at one month, three months, six months and one year postoperatively.

Schroeter 2021 reported the mean absolute error (MAE) as defined as the difference between the predicted and achieved postoperative spherical equivalence refraction.

The definition in Yu 2015 for "absolute deviation between the attempted and achieved spherical equivalent" was consistent with that for "mean absolute error" in the studies Filkorn 2012 and Mastropasqua 2014b, and so we used these studies for Analysis 1.13. We only used data from the longest follow-up time point for the analysis. There was substantial heterogeneity (I^2 = 85%). Individual study results ranged from -0.58 dioptres in favour of FLACS to 0.10 in favour of PCS.

As the estimate provided by Yu 2015 was an outlier in this analysis, we conducted a sensitivity analysis excluding the study. This analysis did not materially change the effect estimates for this outcome measure.

Sensitivity analyses

We explored the effect of excluding within-person (paired-eye) studies for the outcomes that were both meta-analysed and included in the summary of findings table. Excluding these studies did not change the effect estimates substantially although confidence intervals were wider because there were fewer data included in the analyses (Table 1).

DISCUSSION

Summary of main results

We found 42 randomised studies meeting the inclusion criteria. Reporting was variable on the types of intraoperative and postoperative complications. Twenty-seven of the 42 studies reported data on intraoperative complications; in 16 of these studies there were either no anterior or posterior capsule tears. In the 11 studies in which these complications occurred, there were few events.

Twenty-five studies reported data on overall postoperative visual acuity outcomes, of which data from 13 studies were sufficient to combine for analyses. We found little evidence of any meaningful difference in postoperative visual acuity between laser-assisted and standard phacoemulsification arms. There was a small advantage for the laser-assisted arm at six months in CDVA (seven studies only). However, the difference was equivalent to 1 logMAR letter and, even if this is not a type one error, we considered this to be clinically insignificant as this difference is unlikely to have an conceivable or meaningful impact on the patient's vision in daily life. Similarly, there was a small difference in postoperative refraction prediction error (mean absolute error) in favour of laser-assisted surgery, but the confidence intervals for this estimate included a clinically insignificant effect. There was a slightly lower endothelial cell loss in laser-assisted cases but, once again, the confidence intervals for this estimate included a clinically insignificant effect.

None of the studies were powered to investigate for differences in complication rates.

It is also worth noting that in 16 of the 42 studies the authors reported financial links with the manufacturer of the laser platform evaluated in their studies.

Overall completeness and applicability of evidence

Of the 42 RCTs that met the inclusion criteria, none reported data for every outcome measure. Data on anterior or posterior capsule tears were reported by 27 of the 42 included studies, however only seven reported usable data on visual outcomes with at least six months follow-up. Although vision is the primary outcome in all studies, assessment of visual acuity is not clearly specified in all the papers. Given the variety of ways in which vision can be assessed, there is likely to be variation in vision assessment in the different papers even though the results are from reputable institutions and research groups. Three studies reported data on visual function measured by patient-reported outcome measures and two studies presented data on cost-effectiveness. Sixteen studies reported data on endothelial cell counts and changes in endothelial cell counts. There is likely to be variation in endothelial cell count assessment in the different studies as it can be measured by a variety of instruments and can also be impacted by corneal oedema, a common postoperative complication of cataract surgery. Furthermore, given that only a small amount of the cornea is measured, it is likely that different parts of the cornea were measured in the different studies.

Our review focused on the key safety outcomes of anterior and posterior capsule tears. Limited data were available on other potential intraoperative complications, such as zonular dialysis, aphakia and nucleus drop, which may be of interest to clinicians.

Quality of the evidence

Overall, we graded the certainty of the evidence as moderate or low. We downgraded the evidence for risk of bias because the studies were poorly reported, and largely it was unclear as to the extent to which bias had been avoided. We judged most studies to be at high risk of performance bias and one study to be at high risk of performance, detection and attrition bias. The investigators in 16 studies had financial links with the manufacturers of the laser platforms. Only three of the studies were prospectively registered and some of the studies were published by the same research groups; it was not always possible to tell whether participants were double-counted.

In general, we did not downgrade for imprecision as the number of participants in the pooled analyses was large. In cases where the event risk was low and the relative effect was imprecisely measured, we usually judged the imprecision in the absolute effect to be small. There was some unexplained heterogeneity for some outcomes, and so we downgraded for inconsistency in those cases.

Potential biases in the review process

None of the within-person (paired-eye) studies were reported appropriately. We have collected and analysed the data as reported, which is a potential unit of analysis error. Due to a lack of information on the correlation between eyes, we were unable to apply the Becker-Balagtas method as is usually recommended (Stedman 2011). For our primary outcomes - anterior and posterior

capsule tears - as data were sparse it is likely that this unit of analysis error will be a conservative one. For the outcomes meta-analysed and included in the summary of findings table only, we conducted a sensitivity analysis excluding within-person studies. This analysis did not materially change the effect estimates for any of these outcome measures.

It is important to note the limitations of Peto's method regarding rare events meta-analysis. This method is appropriate when the event rate is very low (< 1%), the treatment groups are balanced and the effects are not very large (Efthimiou 2018). If these conditions do not hold, Peto's method gives biased results. For all the outcomes measures analysed using Peto's method, all these conditions were met.

Femtosecond laser-assisted cataract surgery is a rapidly developing area, and although we re-ran the searches during the review and further update to ensure it is up-to-date, it is possible that a published study may have been missed.

Agreements and disagreements with other studies or reviews

Several large case series have been published reporting outcomes of FLACS. Anterior capsular tear rates range from 0.08% to 1.84% (Abell 2015; Chee 2015; Day 2014; Roberts 2013; Roberts 2015), and posterior capsular tear rates range from 0.27% to 0.43% (Abell 2015; Chee 2015; Roberts 2013). In a prospective consecutive comparative case series of 1852 FLACS and 2228 control cases (Abell 2015), the rates of significant intraoperative complications were low in both groups, and both techniques were thought to be equally safe, although the odds of anterior capsule tear rates were higher in FLACS cases (1.84% versus 0.22% in the standard phacoemulsification group). Chee 2015 compared visual outcomes in a non-randomised case series of 794 FLACS operations with 420 matched manual phacoemulsification controls. They found a higher proportion with a postoperative UDVA of 20/25 or better in the laser cases (68.6% versus 56.3%), and a trend towards lower MAE in the laser cataract surgery cases (0.30 D, SD 0.25 D laser versus 0.33 D, SD 0.25 D controls). A recent comparative case series found no clinically meaningful difference in visual outcomes between 988 FLACS and 888 PCS cases (laser postoperative CDVA 0.09 logMAR (SD 0.13) versus standard phacoemulsification 0.12 logMAR (SD 0.22) (P = 0.001), and also a high MAE in laser-assisted cases (0.41 D versus 0.35 D; P < 0.0011) (Ewe 2016).

Several meta-analyses have also been published comparing outcomes in FLACS and PCS. Popovic 2016 compared the safety and efficacy of FLACS and PCS by including 14,567 eyes from 15 randomised controlled trials and 22 observational cohort studies. They found no difference between FLACS and PCS for visual and refractive outcomes. There was a higher rate of posterior capsular tears in the FLACS group. The FLACS group also had less effective phacoemulsification time and a lower amount of endothelial cell reduction. Wang 2019 found higher rates of anterior capsular tears and raised intraocular pressure when comparing 3354 FLACS and 3802 PCS cases. However, there was no difference in rates of posterior capsular tears. Kolb 2020 included a total of 73 studies (25 randomised controlled, 48 observational) with a total of 12,769 eyes treated with FLACS and 12,274 eyes treated with PCS. They found that rates of anterior capsular tears were higher in the FLACS group. There was no difference between the groups with regard to visual acuity at one week and after six months, or in posterior capsule rupture rates and endothelial cell loss after six months.

AUTHORS' CONCLUSIONS

Implications for practice

The evidence from the 42 randomised controlled trials (RCTs) included in this review suggests that there is probably little or no difference when comparing laser-assisted cataract surgery to standard manual phacoemulsification in terms of most intraoperative and postoperative complications, postoperative visual acuity and quality of life. Evidence from two studies suggests that FLACS may be the less cost-effective option. This may have implications for consent when discussing with patients their surgical options. The evidence may not be strong enough for them to pick FLACS over PCS due to safety. If cost is a relevant consideration, such as in the cases of patients paying for their own treatment, they may wish to consider the cost of treatment.

Implications for research

As complications occur rarely, large, adequately powered, well-designed, independent RCTs comparing the safety and efficacy of laser-assisted cataract surgery with standard phacoemulsification cataract surgery are still needed, specifically comparing rates of posterior capsular tears. Furthermore, other sources (non-trial) of evidence may be important for these rare outcomes. Although safety was our primary outcome measure as evaluated by the occurrence of anterior and posterior capsular tears in FLACS and PCS, the evidence generated will be stronger if future studies include information on other intraoperative complications and certain complications specific to FLACS such as incomplete capsulotomy. There are several ongoing trials and these studies may resolve the uncertainty regarding the equivalence or superiority of FLACS compared to PCS. Standardised reporting of intraoperative and postoperative complications, and visual and refractive outcomes for cataract surgery, would facilitate future synthesis of trials. Recommendations for the reporting of intraocular lens-based surgery, so including cataract surgery, have recently been reported (Reinstein 2017). If future RCTs follow this reporting guidance and additionally report mean logMAR visual acuity values (with standard deviations), then this would greatly facilitate future meta-analyses. RCTs should follow the CONSORT guidance in their reporting. Data on patient-reported outcomes and cost-effectiveness are also needed. Unit of analysis issues must be considered when conducting ophthalmic RCTs.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Chee 2021

Study characteristics	
Methods	Parallel-group RCT

Chee 2021 *(Continued)*

Participants	93 participants, randomised to standard phacoemulsification (48), or FLACS with grid pattern (22), or FLACS with 16 segment fragmentation (23) Number of participants randomised: 93 Number of eyes included: 93 Country: Singapore Average age: 75.8 years PCS control arm, 72.0 years FLACS (16 segment), 73.5 years FLACS (grid) Exclusion criteria were an endothelial cell count of 1500 cells/mm^2; eyes unsuitable for FLACS, such as tight sunken palpebral apertures; and unco-operative patients and cataracts with additional complexities, for example, white cataracts, zonulysis, small pupils (< 6 mm diameter); advanced glaucoma; and capsule fibrosis
Interventions	Laser-assisted cataract surgery using the Victus (Bausch & Lomb, Munich, Germany) or manual phacoemulsification (Stellaris, Bausch & Lomb, Rochester, New York, USA)
Outcomes	1 month postoperative best-corrected visual acuity (BCVA), ECC, effective phacoemulsification time (EPT) and perioperative complications
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was done by following a set of computer-generated list of random numbers administered by the study co-ordinator.
Allocation concealment (selection bias)	Unclear risk	No method of allocation concealment is described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of those assessing outcomes was described.
Incomplete outcome data (attrition bias) All outcomes	Low risk	There were no missing values at final follow-up.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trial registry entry (trial was not registered).

Chen 2019

Study characteristics

Methods	Parallel-group RCT
Participants	Number of participants randomised: 94 (47 laser arm, 47 control arm) Number of eyes included: 94 (47 laser arm, 47 control arm) Country: China

Chen 2019 *(Continued)*

	Average age: 53 years Sex: 36% female Ethnic group: not described Inclusion criteria: patients who were clinically diagnosed with cataract, specifically, all with monocular cataract, age > 18 years, patients who were willing for cataract surgery and ready for 6 months follow-up Exclusion criteria: age < 18 years, with severe mental illness, systemic disease, patients with history of eye diseases such as keratopathy, glaucoma and retinopathy, nystagmus, strabismus and amblyopia, inability of poor pupil dilatation, history of previous eye trauma and surgical history; and patients with blepharospasm, corneal degeneration, hyphema, conjunctivochalasis, defective phacoemulsification time of anterior chamber < 2.4 mm
Interventions	Laser-assisted cataract surgery (platform not described) or manual phacoemulsification (platform not described)
Outcomes	Primary outcome measures: operation time, effective phacoemulsification time, cumulative dissipated energy and fluid amount were compared between the 2 groups Additional data reported: at 1 day after surgery, visual acuity, intraocular pressure, corneal endothelium count, aqueous flare and slit lamp were measured and compared between the 2 groups. The rate of corneal endothelium loss was recorded. At 7 days after surgery, enzyme linked immunosorbent assay was used to compare the level changes of serum inflammatory cytokines IL-6, IL-1β and TNF-α. Incidence rates of postoperative complications were observed between the 2 groups at 3 months after surgery.
Notes	Funding source: not reported Declaration of interest: “No author has a financial or proprietary interest in any material or method mentioned” Date study conducted: January 2016 to September 2017 Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	The method of sequence generation is not described.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There was no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Conrad-Hengerer 2013

Study characteristics	
Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 75 Number of eyes included: 150 Country: Germany Average age: 71 years Sex: 63% female Ethnic group: not described Inclusion criteria: *"All patients enrolled had a visually significant cataract, dilated pupil width of 6.0 mm or larger, and were willing to volunteer for the trial after giving informed consent"* Exclusion criteria: *"The exclusion criteria included a history of serious coexisting ocular disease, uncontrolled glaucoma, optic atrophy or ocular tumors, use of topical or systemic steroids or nonsteroidal anti-inflammatory drugs (NSAIDs) during the previous 3 months, relevant corneal opacities, poorly dilating pupils (pupil % 6.0 mm), known zonular weakness, age less than 22 years, or participation in another clinical study"*
Interventions	Laser-assisted cataract surgery using the Catalys platform (Catalys Precision Laser System, AMO) or manual phacoemulsification using a Stellaris phaco machine (Bausch & Lomb)
Outcomes	Primary outcome measures: corneal endothelial cell loss and corneal thickness at up to 3 months Additional data reported: effective phacoemulsification time, mean irrigation fluid volume, mean surgical time, intraoperative and postoperative complications
Notes	Funding source: not reported Declaration of interest: *"Dr. Dick is a member of the medical advisory board of OptiMedica Corp"* Date study conducted: February 2012 to July 2012 Trial registration number: not reported

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	The method of sequence generation is not described.
Allocation concealment (selection bias)	Unclear risk	*".... the surgeon opened the corresponding envelope, receiving information about the procedure to use in each eye; that is, femtosecond laser - assisted or standard phacoemulsification".*
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible; no efforts to mask participants are described.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	*"All patients had a full clinical examination by the same masked trained technician".*

Conrad-Hengerer 2013 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Low risk	*"Two patients were excluded at the 3-month follow-up because they missed their previous visits. One patient had cancer and wasnot available for further visits; the other moved to another county*".
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Conrad-Hengerer 2014

Study characteristics	
Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 104 Number of eyes included: 208 Country: Germany Average age: 71 years Sex: 56% female Ethnic group: not described Inclusion criteria: only the exclusion criteria below are given Exclusion criteria: *"history of coexistent ocular disease (eg, glaucoma, high myopia, retinal diseases affecting the macula, optic atrophy, or ocular tumors), use of topical or systemic steroids or nonsteroidal anti-inflammatory drugs during the prior 3 months, relevant corneal opacities, age younger than 22 years, or participation in another clinical study"*
Interventions	Laser-assisted cataract surgery using the Catalys platform (Catalys Precision Laser System, AMO) or manual phacoemulsification using a Stellaris phaco machine (Bausch & Lomb)
Outcomes	Primary outcome measures: laser flare counts and changes in macular thickness and volume Secondary outcome measures: absolute and effective phacoemulsification time; intraoperative and postoperative complications Follow-up was 6 months postoperatively
Notes	Funding source: not reported. Declaration of interest: *"Dr. Dick was a member of the medical advisory board of OptiMedica. The remaining authors have no financial or proprietary interest in the materials presented herein"* Date study conducted: March 2012 to October 2012 Trial registration number: not reported

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	The method of sequence generation is not described.

Conrad-Hengerer 2014 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	*"After positioning the patient on the operating bed, the surgeon opened the corresponding envelope indicating which procedure to choose (ie, femtosecond laser-assisted or standard phacoemulsification)".*
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible; no efforts to mask participants are described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Low risk	*"Two hundred two eyes (97%) were included and analyzed at 6 months postoperatively."* No further information is given.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Conrad-Hengerer 2015

Study characteristics	
Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 100 Number of eyes included: 200 Country: Germany Average age: 72 years Sex: 56% female Ethnic group: not described Inclusion criteria: *"a potential corrected visual acuity of 0.8 (20/25) in both eyes"* Exclusion criteria: *"amblyopia, a history of serious coexistent ocular disease (eg, pseudoexfoliation, uncontrolled glaucoma, macular pathologies, high myopia, or hyperopia, defined as an axial length [AL] < 21.5 mm or > 27.5 mm), corneal astigmatism of more than 1.5 diopters (D), optic atrophy, ocular tumors, use of topical or systemic steroids or nonsteroidal anti-inflammatory drugs during the previous 3 months, relevant corneal opacities, Fuchs dystrophy, cornea guttata, an age younger than 22 years, and participation in another clinical study. Furthermore, a dilated pupil of at least 6.0 mm preoperatively was necessary"*
Interventions	Laser-assisted cataract surgery using the Catalys platform to produce capsulotomy and lens fragmentation; or manual phacoemulsification cataract surgery
Outcomes	*"Primary outcome measures were early and late corrected distance visual acuity (CDVA) and the deviation from the target refraction using the spherical equivalent (SE) refraction. Secondary outcome measures were anterior chamber depth (ACD) and keratometry values"*
Notes	Funding source: not reported

Conrad-Hengerer 2015 *(Continued)*

Declaration of interest: *"Dr. Dick is a member of the medical advisory board of Abbott Medical Optics, Inc. No other author has a financial or proprietary interest in any material or method mentioned"*

Date study conducted: not reported
Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	The method of sequence generation is not described.
Allocation concealment (selection bias)	Unclear risk	*"After placing the patient on the laser system's operating bed, the surgeon opened the corresponding envelope providing the information about which procedure to use; that is, femtosecond laser-assisted cataract surgery or regular phacoemulsification".*
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible; no efforts to mask participants are described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Low risk	*"Six months postoperatively, 196 eyes were included and analyzed."* No further details are given.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Day 2020

Study characteristics

Methods	Parallel-group RCT
Participants	Number of participants randomised: 785 Number of eyes included: 785 Country: United Kingdom Average age: 68 years laser arm, 68 years control arm Sex: 54% females laser arm, 51% males control arm Ethnic group: 72% White laser arm, 69% White control arm Inclusion criteria: adults aged 18 or over with visually symptomatic cataract (one or both eyes), patients must be sufficiently fluent in English to provide informed consent and completion of the patient-reported outcome measures, patients must be willing to attend for follow-up at 3 and 12 months following surgery to the study eye, postoperative intended refractive target in the study eye is within ± 0.5 dioptres emmetropia Exclusion criteria: eyes with corneal ring and/or inlay implant(s), or severe corneal opacities, corneal abnormalities, significant corneal oedema or diminished aqueous clarity that is likely to obscure OCT imaging of the anterior lens capsule, descemetocele with impending corneal rupture, poor pupil dilation that is expected to require surgical iris manipulation, subluxed crystalline lens, patient unable to give consent or unable to attend follow-up assessment, patient unable to be positioned for surgery, patient scheduled to undergo combined surgery, e.g. cataract and trabeculectomy, any contraindications

Day 2020 *(Continued)*

	to cataract surgery, any clinical condition which the investigator considers would make the patient unsuitable for the trial, including pregnancy
Interventions	Laser-assisted cataract surgery using the Catalys femtosecond laser (Johnson & Johnson Inc., New Brunswick, NJ; St. Ann's Moorfields Eye Hospital, London, UK) or Ziemer LDV 8 (Ziemer Ophthalmic Systems AG, Port, Switzerland; Sussex Eye Hospital, Brighton & New Cross Hospital, Wolverhampton, UK) or manual phacoemulsification (system not specified)
Outcomes	Primary outcome measures: unaided distance visual acuity (UDVA, logMAR) at 3 months following surgery on the study eye Additional data reported: unaided distance visual acuity (UDVA) at 12 months following surgery in the study eye, corrected distance visual acuity (logMAR) at 3 and 12 months following surgery in the study eye, ocular complications within 3 and 12 months of surgery in the study eye. (A complication will be defined as any event that causes unintentional injury to an ocular structure, or requires additional treatment, or has a negative effect on a patient's health or eyesight), unaided and corrected visual acuity and complications in the second eye (for those with bilateral cataracts), and with both eyes open at 3 and 12 months following surgery on the study eye, proportion of patients with vision within 0.5 and within 1 dioptre of the intended refractive outcome at 3 and 12 months following surgery on the study eye, patient-reported outcome: vision health status at 3, 6 and 12 months: Catquest9-SF, cost-utility analysis: within-trial cost-effectiveness analyses at 12 months and expected cost-effectiveness over patient lifetime, corneal endothelial cell count (additional safety measure) in both eyes at 3 and 12 months following surgery in the study eye.
Notes	Funding source: the trial was funded by the UK National Institute for Health Research Health Technology Assessment programme. The National Institute of Health Research had input to the trial design through peer review of the funding proposal but had no role in data collection, data analysis, or writing of this report but had sight of the final version of the article before publication. Declaration of interest: the author(s) have no proprietary or commercial interest in any materials discussed in this article Date study conducted: May 2015 to July 2017 Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was performed on the day of surgery using a web-based, online, sealed envelope-based system
Allocation concealment (selection bias)	Unclear risk	Randomisation was performed on the day of surgery using a web-based, online, sealed envelope-based system
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Postoperative assessments were masked to the allocated intervention
Incomplete outcome data (attrition bias) All outcomes	Low risk	Of note, we did observe a small difference in the 3-month follow-up rates for FLACS versus PCS, with 90% of FLACS cases attending compared with 80% for PCS. Participants who did not attend were contacted by identical methods to rebook within trial timescales, and an additional sensitivity analysis does not suggest a difference in the characteristics of those who were lost to follow-up.
Selective reporting (reporting bias)	Low risk	The outcomes of interest were reported in the prespecified way in both the protocol and in the published report.

Dick 2014

Study characteristics	
Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 53 Number of eyes included: 106 Country: Germany Average age: 71 years old Sex: 57% female Ethnic group: not described Inclusion criteria: *"a visually significant cataract (corrected distance visual acuity < 20/25) in both eyes, dilated pupil width of 6.0 mm or greater, and were willing to volunteer for the trial after giving an informed consent"* Exclusion criteria: *"included corneal scars, corneal diseases, corneal astigmatism of 1.5 diopters or greater, reduced endothelial cells, glaucoma, pseudoexfoliation syndrome, zonular weakness, single eye, malformations, history of ocular surgery, intraocular tumours, active or past inflammations, age-related macular degeneration, diabetic retinopathy, axial length difference (greater than 0.5 mm and less than 21.5 mm or greater than 26 mm), pregnancy, reduced compliance, age younger than 22 years, or participation in another clinical study"*
Interventions	Laser-assisted cataract surgery using the Catalys platform (Catalys Precision Laser System, AMO) or manual phacoemulsification using a Stellaris phaco machine (Bausch & Lomb)
Outcomes	Primary outcome measures: absolute capsular bag diameters and intraindividual difference in milliammeters Additional data reported: phacoemulsification energy used Follow-up was 3 months
Notes	Funding source: not reported Declaration of interest: *"The authors have no financial or proprietary interest in the materials presented herein"* Date study conducted: not reported Trial registration number: not reported

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	The method of sequence generation is not described.
Allocation concealment (selection bias)	Unclear risk	*"For randomization, the patient was placed on the operating bed of the laser system and a corresponding envelope with the information about the receiving procedure was opened by the surgeon*".
Blinding of participants and personnel (performance bias)	High risk	Surgeon masking is not feasible for the study methodology described.

Dick 2014 *(Continued)*

All outcomes		
Blinding of outcome assessment (detection bias) All outcomes	Low risk	*"All slit-lamp measurements were done by a single trained technician who was blinded to the surgical technique*".
Incomplete outcome data (attrition bias) All outcomes	Low risk	All patients were included in the 3-month follow-up.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Donnenfeld 2018

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 30 Number of eyes included: 30 Country: USA Average age: 67 years laser arm, 68 years control arm Sex: 54% female laser arm, 67% female control arm Ethnic group: 74% white laser arm, 87% white control arm Inclusion criteria: Grade 1 to Grade 3 nuclear cataracts, normal wound healing and no systemic corticosteroids Exclusion criteria: Grade 4 nuclear cataracts, collagen vascular disease, systemic corticosteroids, patients who could not co-operate with the docking mechanism at the time of surgery, eyes that did not dilate to at least 6.0 mm and keratoconus
Interventions	Laser-assisted cataract surgery using the Catalys platform (Abbott Medical Optics, Inc.) or manual phacoemulsification (phacoemulsification system not described)
Outcomes	Primary outcome measures: the intraocular pressure at which wounds leaked and severity of wound leakage immediately post-surgery and 1 day, 2 weeks and 1 month postoperatively Additional data reported: other examinations included evaluation of pupil size, sphere, cylinder, manifest refraction spherical equivalent, uncorrected distance visual acuity, corrected distance visual acuity, topography, slitlamp examination and surgical complications
Notes	Funding source: not reported Declaration of interest: Dr. Uy has received research funding from LENSAR, Inc. and Novartis AG. Dr. Shah is a consultant to Lenstec, Inc. and Oculentis GmBH and has received speaker fees and research funding from LENSAR, Inc. Dr. Packer is a consultant to Alcon (Novartis AG), Bausch & Lomb (Valeant Pharmaceuticals International, Inc.), Keranova, and LENSAR, Inc. Date study conducted: not reported Trial registration number: not reported

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	The patients included in the study were randomised by a random number generated list to receive 1 of the 3 types of primary corneal incisions.

Donnenfeld 2018 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Postoperatively, the ophthalmologist performing the wound evaluations (A.N.) was not the operating surgeon and was masked to all incision types.
Incomplete outcome data (attrition bias) All outcomes	Low risk	45 eyes were included in the study and subsequent analysis.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Dzhaber 2020

Study characteristics	
Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 67 Number of eyes included: 134 Country: USA Average age: 68 years Sex: 57% female Ethnic group: not described Inclusion criteria: ≥ 18 years old, had bilateral visually significant cataract and were able to attend follow-up for at least 3 months postoperatively Exclusion criteria: Fuchs' corneal endothelial dystrophy, other ocular pathology and/or previous/concurrent ocular surgery
Interventions	Laser-assisted cataract surgery using the LenSx (Alcon Laboratories Inc) or manual phacoemulsification using the Infiniti Vision System (Alcon Laboratories)
Outcomes	Primary outcome measures: changes in postoperative endothelial cell density and central corneal thickness Additional data reported: targeted intraoperative parameters and included effective phacoemulsification time, cumulative dissipated energy, amount of balanced salt solution use and operating time, as well as intraoperative complications. Postoperative outcomes were measured at 1 day, 1 week, 1 month and 3 months postoperatively.
Notes	Funding source: unrestricted research grants from the Michael O'Bannon Foundation and the Turner Family Declaration of interest: no competing interests declared Date study conducted: April 2015 to March 2018 Trial registration number: not reported
Risk of bias	
Bias	**Authors' judgement** / **Support for judgement**

Dzhaber 2020 *(Continued)*

Random sequence generation (selection bias)	Low risk	For each patient, the worse seeing eye was randomised by the type of procedure into either FLACS or PCS using an online random number generator.
Allocation concealment (selection bias)	Unclear risk	On the day before the surgery, the surgeon was informed about the type of procedure to use in each eye.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Low risk	However, 10 participants were later excluded. Of those, two participants had PCS in both eyes (inability to perform FLACS due to anatomical features) and another two had FLACS in both eyes (due to patient's preference after having FLACS in the first eye). Six patients missed their 3 months' follow-up visit.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered)

Filkorn 2012

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 134 (77 laser arm, 57 control arm) Number of eyes included: 134 (77 laser arm, 57 control arm) Country: Hungary Average age: 65 years laser arm, 64 years control arm Ethnic group: not described Inclusion criteria: not described Inclusion criteria: previous ocular surgery, corneal diseases such as keratoconus, known zonular weakness, corneal astigmatism 3.00 D, anterior capsule tear, posterior capsule rupture, severe macular disease, and amblyopia
Interventions	Surgical intervention: laser-assisted cataract surgery using the LenSx (Alcon Laboratories Inc) or manual phacoemulsification (Accurus, Alcon Laboratories Inc)
Outcomes	Intraocular lens power calculation, visual and refractive outcomes
Notes	Funding source: not reported Declaration of interest: *"Drs Knorz and Nagy are consultants to Alcon LenSx Inc. All remaining authors have no financial interest in the materials presented herein"* Date study conducted: not reported Trial registration number: not reported

Filkorn 2012 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Participants were randomly assigned to each group using a computer randomisation chart.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	As participants with complications were excluded and this number was not provided, we are unable to judge if large or small numbers were excluded.
Selective reporting (reporting bias)	Unclear risk	*"Patients with CDVA 20/40 or worse were excluded (one patient in each group) to avoid errors in manifest refraction".* No access to study protocol or trials registry entry (trial was not registered).

Hansen 2020

Study characteristics

Methods	Parallel-group RCT
Participants	Number of participants randomised: 96 Number of eyes included: 135 Country: United States of America Average age: 69 years laser arm, 69 years control arm Sex: 61% females Ethnic group: not specified Inclusion criteria: adults aged between 21 and 99 years at the time of surgery suitable for FLACS between October 2015 and June 2017 were eligible for inclusion. Contact lens wearers were required to cease use of contacts until their corneal topography was stable before screening measurements were performed. Exclusion criteria: participants were excluded if there was pre-existing ocular pathology, including corneal disease or scarring, retinopathy, vitreous haemorrhage, uveitis, optic neuropathy (including glaucomatous optic neuropathy) or amblyopia. Participants with previous ocular surgery, posterior polar cataracts, phacodonesis, white or advanced cataract (precluding adequate examination of the posterior segment), anatomic conditions that would prevent adequate docking of the femtosecond laser, pupil dilation less than 6.0 mm, or potential postoperative visual acuity determined by Guy-

Hansen 2020 *(Continued)*

	ton-Minkowski Potential Acuity Meter (Mentor), or super near pinhole of less than 20/30 were also excluded.
Interventions	Laser-assisted cataract surgery using the LenSx (Alcon Laboratories Inc) or manual phacoemulsification using the Alcon Centurion System (Alcon Laboratories, USA)
Outcomes	Primary outcome measures: CDVA, UDVA and undilated ophthalmologic examination at day 1, week 1, month 1 and month 3 postoperatively Additional data reported: intraoperative complications and cumulative dissipative energy and irrigation fluid usage was noted. The surgeons filled out a questionnaire at the end of surgery and the patients also completed a questionnaire at the postoperative visits.
Notes	Funding source: partially supported by an unrestricted grant from Research to Prevent Blindness, Inc., New York, New York, USA, and by a core grant from the NIH (NIH P30 EY030413). The sponsor or funding organisations had no role in the design or conduct of this research. Declaration of interest: none of the authors has a financial or proprietary interest in any material or method mentioned Date study conducted: October 2015 to June 2017 Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Mechanism of randomisation not described.
Allocation concealment (selection bias)	Unclear risk	No mention of allocation concealment.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of those assessing outcomes was described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There was no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Hida 2014

Study characteristics

Methods	Parallel-group RCT
Participants	Number of participants randomised: 80 (40 laser arm, 40 control arm)

Hida 2014 *(Continued)*

	Number of eyes included: 80 (40 laser arm, 40 control arm) Country: Brazil Average age: 67 years laser arm, 65 years control arm Ethnic group: not described Inclusion criteria: not described Exclusion criteria: not described
Interventions	Surgical intervention: laser-assisted cataract surgery using the LenSx (Alcon Laboratories Inc) or manual phacoemulsification (phacoemulsification system not described)
Outcomes	Capsulotomy/capsulorhexis circularity and postoperative spherical equivalent
Notes	Funding source: not reported Declaration of interest: *"The authors declare no conflicts of interest"* Date study conducted: October 2013 to January 2014 Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	The method of sequence generation is not described.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Hida 2017

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 400 Number of eyes included: 400

Hida 2017 *(Continued)*

	Country: Brazil Average age: 68 years laser arm, 69 years control arm Sex: not described Ethnic group: not described Inclusion criteria: patients aged between 59 and 80 years and had a diagnosis of cataract and planned phacoemulsification for one or both eyes Exclusion criteria: presence of white cataracts, need for mechanical dilation of pupil, weak or broken zonular fibres, known zonular instability or zonular dehiscence
Interventions	Laser-assisted cataract surgery using the LenSx (Alcon Laboratories Inc) or manual phacoemulsification using the Alcon Centurion System (Alcon Laboratories, USA)
Outcomes	Primary outcome measures: cumulative dissipated energy (CDE), torsional time (s), longitudinal time (s) (Intelligent Phaco IP), case time (s), fluid usage (s) and aspiration time (s) Additional data reported: Pre- and postoperative endothelial cell count and intraoperative complications
Notes	Funding source: not reported Declaration of interest: none of the authors has a financial or proprietary interest in any material or method mentioned Date study conducted: August 2015 to January 2016 Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	The method of sequence generation is not described.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Kanellopoulos 2016

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 133 (67 laser arm, 66 control arm)

Kanellopoulos 2016 *(Continued)*

	Number of eyes included: 133 (67 laser arm, 66 control arm) Country: Greece Average age: 67 years laser arm, 70 years control arm Sex: 60% female laser arm, 56% female control arm Ethnic group: not described Inclusion criteria: *"Successful primary cataract removal and IOL intracapsular bag insertion cases with or without toric IOL use. Preoperative myopia up to -14.00 D, hyperopia of up to +8.00 D, and up to -5.00 D of astigmatism. Pre-operative endothelial cell density (ECD) of more than 1,700 cells/mm2."* Exclusion criteria: *"Clinically significant corneal abnormalities including basement membrane dystrophy and endothelial dystrophy, significant superficial punctuate keratitis, poorly dilating pupil in relation to the intended capsulotomy diameter, or other abnormalities that in the surgeon's opinion (AJK) would negatively affect the safe outcome of the procedure, such as any sign of corneal disease and corneal scar within the optical zone. No cases were included in the study if pre-operative macular degeneration was noted prior to the procedure to avoid influence on visual acuity and refraction data. Additionally no cases that had prior cornea surgery (e.g. laser-vision correction) were included."*
Interventions	Surgical intervention: laser-assisted cataract surgery using the LenSx (Alcon Laboratories, Inc.) or manual phacoemulsification using the Constellation (Alcon Laboratories, Inc.)
Outcomes	All cases were evaluated for refraction, visual acuity, keratometry, tomography, pachymetry, endothelial cell counts, intraocular pressure
Notes	Funding source: unrestricted funding from Alcon Laboratories (IIT 10247941) Declaration of interest: a) Funding/support: unrestricted grant by Alcon. b. Financial disclosures: Consultant/advisory positions: author AJK: Alcon/WaveLight, Allergan, Avedro, i-Optics, Keramed; ISP Surgical, Optovue, Zeiss, author GA: none Date study conducted: not reported Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	The decision to perform either manual capsulorhexis and ultrasound phacoemulsification or femtosecond laser-assisted procedure was based on random choice (randomisation table) prior to the operation.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	The associate optometry staff collected data during the scheduled patient visits, not aware, at the time of the data collection, of the potential future use of these data for the purpose of the present analysis.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	All cases were completely evaluated until the 3-month interval; 60 were available for the 6-month interval, and 59 were available for the final, 1-year follow-up. No breakdown by group for loss to follow-up is presented.

Kanellopoulos 2016 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Khan 2017

Study characteristics

Methods	Parallel-group RCT
Participants	Number of participants randomised: 48 Number of eyes included: 50 Country: Pakistan Average age: 54 years laser arm, 55 years control arm Sex: 52% females Ethnic group: not described Inclusion criteria: patients with age ranging from 40 to 80 years and suffering from age-related cataract Exclusion criteria: patients with mature, hypermature, morgagnian, secondary or traumatic cataract were excluded from the study. In order to minimise the effect of other confounding variables, patients with any associated ocular illness such as corneal degeneration, corneal dystrophy, pseudo exfoliation, diabetic retinopathy, glaucoma, uveitis were also excluded.
Interventions	Laser-assisted cataract surgery using the LenSx (Alcon Laboratories Inc) or manual phacoemulsification using the Alcon Centurion System (Alcon Laboratories, USA)
Outcomes	Primary outcome measures: endothelial cell count Additional data reported: intraoperative and postoperative complications
Notes	Funding source: not reported Declaration of interest: the authors declare that no financial conflicts of interest exist Date study conducted: January 2016 to August 2017 Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	The method of sequence generation is not described.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.

Khan 2017 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Kovacs 2014

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 79 (40 laser arm, 39 control arm) Number of eyes included: 79 (40 laser arm, 39 control arm) Country: Hungary Average age: 66 years laser arm, 69 years control arm Sex: 70% female laser arm, 74% female control arm Ethnic group: not described Inclusion criteria: only exclusion criteria are given Exclusion criteria: *"previous ocular surgery, trauma, active ocular disease (eg. pseudoexfoliation syndrome and uveitis), poorly dilated pupils, or known zonular weakness* "
Interventions	Surgical intervention: laser-assisted cataract surgery using the LenSx (Alcon Laboratories, Inc.) or manual phacoemulsification using the Infinity Vision System (Alcon Laboratories, Inc.)
Outcomes	Subgroup analysis of previous RCT (no further data on this given). Primary outcome measure: quantification of posterior capsule opacification at 18 to 26 months postoperatively. Additional data: intraocular lens tilt and decentration.
Notes	"*All patients from a previous prospective, randomised study on femtosecond laser surgery with a minimum follow-up time of 18 months were identified in our database and their data were processed for further statistical analyses.*" No publication reference is given for the original RCT. Funding source: not reported Declaration of interest: "*Drs. Nagy, Donnenfeld, and Knorz are consultants of LenSx Lasers, Inc. The remaining authors have no financial or proprietary interest in the materials presented herein*" Date study conducted: not reported Trial registration number: not reported

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	The method of sequence generation is not described. Patients included were those with a minimum follow-up time of 18 months from a previous RCT.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias)	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.

Kovacs 2014 *(Continued)*

All outcomes		
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Krarup 2021

Study characteristics	
Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 34 Number of eyes included: 68 Country: Denmark Average age: not specified Sex: 50% females Ethnic group: not specified Inclusion criteria: Fuchs' endothelial dystrophy based on findings of guttae > 5, visually significant cataract of any type and degree and age older than 18 years Exclusion criteria: severe dry eye, corneal scars, keratoconus, history of herpetic keratitis, history of uveitis, pseudoexfoliation syndrome, uncontrolled glaucoma, vitreomacular traction, lack of cooperation or tremor and previous ocular surgery. If patients failed to have both eyes operated (one eye with FLACS and the other eye with standard PCS), they were also excluded.
Interventions	Laser-assisted cataract surgery using the LensAR (Topcon, Gamagori, Japan) or manual phacoemulsification using the Infiniti Vision System (Alcon Laboratories)
Outcomes	Primary outcome measures: central corneal thickness, corneal light backscatter, corneal densitometry, and central corneal endothelial cell count and hexagonality (noncontact endothelial cell microscope), and corrected distance visual acuity (CDVA) were assessed preoperatively and at day 1, 40 and 180 postoperatively
Notes	Funding source: not specified Declaration of interest: the authors report no conflicts of interest in this work Date study conducted: not provided Trial registration number: not reported

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Krarup 2021 *(Continued)*

Random sequence generation (selection bias)	Low risk	All patients were randomised using block randomisation by a computer.
Allocation concealment (selection bias)	Unclear risk	Operation method was noted on a file and on operation day the surgeon would open the file and see what operation method was to be performed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. Patients were not masked to the surgery.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	The following measurements were performed by the same optometrist who was blinded to operation method: autorefraction, CDVA with subjective refraction, Pentacam measurements with evaluation of corneal density, CCT, CPRT at 4 mm and 6 mm and endothelial imaging with ECD, hexagonality and rate of polymegethism described by coefficiency of variance.
Incomplete outcome data (attrition bias) All outcomes	Low risk	There were no missing values at follow-up.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Kránitz 2012

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 45 (20 laser arm, 25 control arm) Number of eyes included: 45 (20 laser arm, 25 control arm) Country: Hungary Average age: 64 years laser arm, 68 years control arm Sex: 75% female laser arm, 92% female control arm Ethnic group: not described Inclusion criteria: only exclusion criteria are given Exclusion criteria: *"Patients with previous ocular surgery, trauma, active ocular disease, poorly dilated pupils, or known zonular weakness were excluded from the study*"
Interventions	Surgical intervention: laser-assisted cataract surgery using the LenSx (Alcon Laboratories, Inc.) or manual phacoemulsification using the Accurus phacoemulsification machine (Alcon Laboratories, Inc.)
Outcomes	Intraocular lens decentration and tilt, refraction, UDVA and CDVA.
Notes	Funding source: not reported Declaration of interest: "*Drs Knorz and Nagy are consultants to Alcon LenSx Inc. The remaining authors have no financial interest in the materials presented herein.*" Date study conducted: not reported

Kránitz 2012 *(Continued)*

	Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was done using computer-generated tables.
Allocation concealment (selection bias)	Unclear risk	Randomisation was done using computer-generated tables.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Liu 2021

Study characteristics

Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 85 Number of eyes included: 170 Country: Singapore Average age: 70 years Sex: 44% females Ethnic group: not specified Inclusion criteria: we included patients aged more than 55 years with visually symptomatic senile cataract in both eyes, similar cataract severity in both eyes (with PNS difference less than 2), targeted refractive power after surgery within 0.5 dioptres of emmetropia, willingness and ability to return for scheduled follow-up examinations for 1 year after surgery and those with medically dilated pupil size of at least 5 mm Exclusion criteria: any corneal abnormalities (such as significant corneal asymmetry or irregular topography, corneal opacity, corneal scar, previous corneal or refractive surgery), eyes with lens abnormalities (such as signs of zonular dialysis, phacodonesis, lens dislocation or subluxation), patients scheduled to undergo combined surgery (such as cataract surgery and corneal transplantation), patients with ocular comorbidities (such as retinal diseases, glaucoma, optic nerve diseases) that may affect outcome measures, patients taking oral non-steroidal anti-inflammatory drugs

Liu 2021 *(Continued)*

Interventions	Laser-assisted cataract surgery using the Femto LDV Z8 (Ziemer Ophthalmic Systems AG, Port, Switzerland) or manual phacoemulsification using the Infiniti Vision System (Alcon Laboratories)
Outcomes	Primary outcome measures: phacoemulsification energy parameters (cumulative dissipated energy, phacoemulsification power and phacoemulsification time) Additional data reported: uncorrected and corrected distance visual acuities (UDVA and BDVA), manifest refraction spherical equivalent (MRSE), central corneal thickness (CCT), endothelial cell count (ECC), anterior chamber flare, and postoperative complications were obtained for 1 year. Aqueous humour was collected for the analysis of prostaglandin (PGE)2, cytokines and chemokines concentrations. Patient-reported outcomes on surgical experiences were evaluated using an in-house questionnaire.
Notes	Funding source: this research was supported by the Singapore National Eye Center HREF Grant (R1249/55/2015) Declaration of interest: the authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest Date study conducted: December 2017 to November 2019 Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	The randomisation was performed using random allocation cards from computer-generated random numbers and allocated patients to each treatment group.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Supplementary Figure 1 clearly outlines the number of patients who had procedures done and the number followed up. Those lost to follow-up were accounted for.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Mastropasqua 2014a

Study characteristics

Methods	Parallel-group RCT
Participants	Number of participants randomised: 60

Mastropasqua 2014a *(Continued)*

	Number of eyes included: 60 (right eyes) Country: Italy Average age: 70 years Sex: not described Ethnic group: not described Inclusion criteria: "*age between 65 and 75 years, axial length between 23.0 and 24.0 mm, corneal astigmatism less than 2.00 diopters (D), nuclear cataract of grade 2 to 3 (nuclear opalescence 3/4) (Lens Opacities Classification System III), and corneal endothelial cell count greater than 1,200/mm* " Exclusion criteria: *"pathological alterations of the anterior segment (eg, corneal opacities, 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"*
Interventions	Surgical intervention: laser-assisted cataract surgery using the LenSx platform (Alcon Inc, Fort Worth, TX, USA) or manual phacoemulsification using the Alcon Constellation System (Alcon Laboratories, Inc.)
Outcomes	UDVA and CDVA (logMAR), keratometric astigmatism, corneal endothelial cell count, corneal thickness at the incision site and higher order corneal aberrations. Follow-up was 6 months.
Notes	Funding source: not reported Declaration of interest: *"The authors have no financial or proprietary interest in the materials presented herein"* Date study conducted: not reported Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	The method of sequence generation is not described.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	As patients with complications were excluded and this number was not provided, we are unable to judge if large or small numbers were excluded.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Mastropasqua 2014b

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 90 Number of eyes included: 90 Country: Italy Average age: 69 years Sex: not described Ethnic origin: not described Inclusion criteria: the inclusion criteria were age between 65 years and 75 years, nuclear cataract grade 3 to 4 (nuclear opalescence (NO) 3/4 on Lens Opacities Classification System III), and a corneal endothelial cell count greater than 1200 cells/mm^2 Exclusion criteria: poor pupil dilation, pathology that could alter the anterior segment (e.g. corneal opacities, keratoconus, chronic uveitis, zonular dialysis, pseudoexfoliation syndrome, glaucoma, diabetes), other ocular pathology that can impair visual function, previous anterior or posterior segment surgery, and intraoperative or postoperative complications
Interventions	Participants were randomised to one of 3 treatments with equal probability for each group: a) Laser-assisted cataract surgery using a Lensx femtosecond laser (Alcon Laboratories Inc); the capsulotomy, lens fragmentation and corneal incisions were performed using the femtosecond laser b) Laser-assisted cataract surgery using a Lensar femtosecond laser (Lensar Inc); the capsulotomy and lens fragmentation were performed using the femtosecond laser c) Manual phacoemulsification
Outcomes	Difference in the distance between the intraocular lens centroid and the pupil centroid 180 days after surgery, visual parameters, refractive parameters, circularity, capsulorhexis area, intraocular lens centroid-pupil centroid distance and capsulorhexis centroid-pupil centroid distance)
Notes	Funding source: not reported Declaration of interest: *"No author has a financial or proprietary interest in any material or method mentioned"* Date study conducted: not reported Trial registration number: not reported

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	A computer-generated, 6-block, 15-patient randomisation list was generated using an in-house, closed-source software developed in Matlab (MATLAB 2009). Patients were assigned to 1 of the 3 treatments with an equal probability for each group.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.

Mastropasqua 2014b *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	The trial methodology states: *"The surgeon and the operating room staff were aware of group assignment. The patients were masked to group assignment until the study was completed."* However, it is unclear how the patients could remain masked unless sham laser was performed and there is no description of this.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	*"... examiners performing preoperative and postoperative assessments were masked to group assignment until the study was completed"*
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	As patients with complications were excluded and this number was not provided, we are unable to judge if large or small numbers were excluded.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Menapace 2022

Study characteristics	
Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 60 Number of eyes included: 120 Country: Austria Average age: 71 years Sex: 60% females Ethnic group: not specified Inclusion criteria: we included patients with bilateral age-related cataract, age 40 and older, visual potential of 20/30 or better in both eyes and no medical conditions such as rheumatic diseases or previous artery or vein occlusion in medical history and physical examination Exclusion criteria: the exclusion criteria were a history of ocular disease, preceding ocular surgery or trauma, relevant other ophthalmic diseases (macular degeneration or oedema, pseudoexfoliation, etc.), diabetes and any intraoperative complication
Interventions	Laser-assisted cataract surgery using the Femto LDV Z8 (Ziemer Ophthalmic Systems AG, Port, Switzerland) or manual phacoemulsification using the OS4 phaco machine (Oerteli, Switzerland)
Outcomes	Primary outcome measures: change of central macular thickness (CMT) at 1 week, 3 weeks and 6 weeks postoperatively Additional data reported: effective phacoemulsification time, central macular volume (CMV) and total macular volume (TMV) changes at 1 week, 3 weeks and 6 weeks postoperatively
Notes	Funding source: L. Schwarzenbacher is a recipient of a DOC Fellowship of the Austrian Academy of Sciences (Award Number 25082) Declaration of interest: the authors report no conflicts of interest in this work Date study conducted: not provided

Menapace 2022 *(Continued)*

	Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Before the investigation started, a randomisation list was generated with Datinf Randlist software A (version 2.0, Datinf GmbH, Tubingen, Germany).
Allocation concealment (selection bias)	Unclear risk	A sealed envelope containing the randomisation of each patient was handed to the surgeon in the operating room on the day of surgery.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Surgeon masking is not feasible for the study methodology described. Patients were masked to the surgery.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Patients and investigators were masked to the surgery and the examiner was unaware which surgery the patient had.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	As patients with complications were excluded and this number was not provided, we are unable to judge if large or small numbers were excluded.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Mursch-Edlmayr 2017

Study characteristics

Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 50 Number of eyes included: 100 (50 laser, 50 control) Country: Austria Mean (SD) age: 72 (6) years Sex: 31 (62%) female, 19 male. Ethnic origin: not described Inclusion criteria: minimum age of 18 years and age-related cataract Exclusion criteria: small pupils (< 6.0 mm with therapeutic mydriasis) and manifest glaucoma treated with antiglaucoma drugs
Interventions	Surgical intervention: laser-assisted cataract surgery using the VICTUS™ platform (Bausch & Lomb Technolas) or manual phacoemulsification using the Oertli OS3 system (Oertli Instrumente AG). Mean(SD) time between surgery in fellow eyes 9.1 (9) days.
Outcomes	Intraoperative and postoperative complications and the effective phacoemulsification time (EPT); intraocular lens and capsulotomy centration; CDVA, endothelial cell density (ECD), central corneal thickness (CCT) and central retinal thickness

Mursch-Edlmayr 2017 *(Continued)*

	Follow-up was at: 1 day, 1 week, 1 month, 3 months and 6 months
Notes	Funding source: the Ars Ophthalmica Study Center received research grants from Technolas Perfect Vision GmbH Declaration of interest: "*No author has a financial or proprietary interest in any material or method mentioned*" Date study conducted: not reported Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Balanced block randomisation using Excel software (Microsoft Corp.).
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All examiners at the postoperative follow-up visits were blinded to the randomisation of the patient.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	3 patients (6 eyes) from their total of 50 patients were lost to follow-up. No reasons for loss to follow-up are given.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Nagy 2011

Study characteristics

Methods	Parallel-group RCT
Participants	Number of participants randomised: 105 (53 laser arm, 52 control arm) Number of eyes included: 111 (54 laser arm, 57 control arm) Country: Hungary Average age: 65 years old laser group, 68 years old control group Sex: 72% female laser group, 70% female control group Ethnic group: not described Inclusion criteria: only exclusion criteria are given

Nagy 2011 *(Continued)*

	Exclusion criteria: *"Patients with previous ocular surgery, trauma, active ocular disease, poorly dilated pupils, or known zonular weakness were excluded from the study"*
Interventions	Surgical intervention: laser-assisted cataract surgery using the LenSx (Alcon Laboratories, Inc.) or manual phacoemulsification using the Accurus phacoemulsification machine (Alcon Laboratories, Inc.)
Outcomes	Circularity and area of capsulotomy and intraocular lens decentration
Notes	Funding source: not reported Declaration of interest: *"Drs Nagy and Knorz are consultants to LenSx Lasers Inc. The remaining authors have no proprietary interest in the materials presented herein"* Date study conducted: not reported Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Using computer randomisation, patients and their right/left eyes were randomly selected for femtosecond and manual surgery.
Allocation concealment (selection bias)	Unclear risk	Using computer randomisation, patients and their right/left eyes were randomly selected for femtosecond and manual surgery.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Nagy 2014

Study characteristics

Methods	Parallel-group RCT
Participants	Number of participants randomised: 40 (20 laser arm, 20 control arm) Number of eyes included: 40 (20 laser arm, 20 control arm) Country: Hungary Average age: 70 years laser group versus 62 years control group Sex: not described

Nagy 2014 *(Continued)*

	Ethnic group: not described Inclusion criteria: only exclusion criteria are given Exclusion criteria: *"previous ocular surgery, trauma, active ocular disease, poorly dilated pupils, or known zonular weakness were excluded"*
Interventions	Surgical intervention: laser-assisted cataract surgery using the LenSx platform (Alcon Laboratories Inc) or manual phacoemulsification (platform not described)
Outcomes	Surgically induced astigmatism and corneal higher order aberrations. Additional data reported: intra-operative and postoperative complications. Follow-up was 3 months.
Notes	Funding source: not reported Declaration of interest: *"Dr. Nagy is a consultant for Alcon Laboratories, Inc. The remaining authors have no financial or proprietary interest in the materials presented herein"* Date study conducted: not reported Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"Randomization was done using computer-generated tables (Microsoft Excel; Microsoft Corporation, Redmond, WA)."*
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Oka 2021

Study characteristics

Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 55 Number of eyes included: 110 Country: Japan

Oka 2021 *(Continued)*

	Average age: 73 years Sex: 64% females Ethnic group: not specified Inclusion criteria: we included patients ≥ 20 years old with grade 2 to 4 cataracts per Emery-Little Classification and with planned cataract removal by phacoemulsification in both eyes. Participants had potential corrected distance visual acuity (CDVA) of 0.7 decimal or better in the study eye. Exclusion criteria: excluded from the study were participants with corneal opacity; hypotony or presence of a corneal implant; ocular or eyelid disease; corneal disease that precluded applanation of the cornea or transmission of laser light at 1030 nm; blood or other material in the anterior chamber, poorly dilating pupil, contraindications to cataract surgery, corneal ECD < 2000 cells/mm^2; peripheral iridotomy; two different grades of cataract in both eyes; expected ocular surgical treatment other than Nd:YAG capsulotomy; systemic or ophthalmic disease. Additionally, participants could be excluded from the study during surgery if there were any additional procedures or interventions (i.e. posterior capsule rupture, vitreous loss); incomplete continuous curvilinear capsulorhexis by LenSx; significant anterior chamber bleeding; uncontrolled intraocular pressure; or at the discretion of the surgeon for clinical reasons.
Interventions	Laser-assisted cataract surgery using the LenSx (Alcon Laboratories Inc) or manual phacoemulsification using the Alcon Centurion System (Alcon Laboratories, USA)
Outcomes	Primary outcome measures: cumulative dissipated energy, recorded after the ultrasound portion of the surgery Additional data reported: percent change of endothelial cell density at day 150 to 210 compared with the preoperative visit, average torsional amplitude on surgery day, central corneal thickness and corrected distance visual acuity
Notes	Funding source: this study was funded by Alcon Vision LLC. Medical writing assistance was provided by Natalia Zhukovskaya, PhD, of ICON (North Wales, PA), and was funded by Alcon. Declaration of interest: VP Injev and N Sasaki are Alcon employees. Y Oka received grant support from Alcon Japan Ltd. The authors report no other conflicts of interest in this work. Date study conducted: August 2018 to May 2019 Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Participants were randomised using random assignment by the permutated block method, with 1 eye assigned to FLACS and the other eye to conventional techniques.
Allocation concealment (selection bias)	Unclear risk	Randomisation information was masked to the specular microscope observer other than the surgeon.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described.
Blinding of outcome assessment (detection bias)	Low risk	Randomisation information was masked to the specular microscope observer other than the surgeon.

Oka 2021 *(Continued)*
All outcomes

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	As patients with complications were excluded and this number was not provided, we are unable to judge if large or small numbers were excluded.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Pahlitzsch 2018

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 343 Number of eyes included: 343 Country: Germany Average age: 69 years laser arm, 72 years control arm Sex: not described Ethnic group: not described Inclusion criteria: the nuclear density score LOCS II, III and IV; pupil size in mydriasis 5.5 mm to 6 mm; anterior chamber depth 2.3 mm to 2.5 mm; no other surgery < 3 months; and a systemic disease in a stable condition (diabetes HbA1c maximum 7% and controlled hypertensive blood pressure) Exclusion criteria: LOCS I, astigmatism > 1 dioptre, spherical error > 3 dioptre, intraocular pressure > 21 mmHg, uncontrolled systemic disease (diabetes and hypertensive blood pressure), autoimmune disease, uveitis, keratitis and hazy optic media
Interventions	Laser-assisted cataract surgery using the LenSx (Alcon Laboratories Inc) or manual phacoemulsification using the Alcon Centurion System (Alcon Laboratories, USA)
Outcomes	Primary outcome measures: cumulative dissipated energy (CDE%s), balanced salt solution volume (BSSml), total longitudinal energy (%s) and torsional amplitude (%s) Additional data reported: visual acuity was assessed pre-operatively, 1 day, 1 week and 1 month post-surgery. The safety parameter intraocular flare value (photon counts/ms, laser flare photometry, FM-700 Kowa, Tokyo, Japan) was observed preoperatively and 1 week postoperatively.
Notes	Funding source: not reported Declaration of interest: the authors declare that no financial conflicts of interest exist Date study conducted: January 2015 to April 2016 Trial registration number: not reported

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	For randomisation into the 4 study cohorts, a software program (STATA version 11; Stata Corp., College Station, TX, USA) was used.
Allocation concealment (selection bias)	Unclear risk	After primary assessment of participants, individuals were allocated to each surgery and tip arm, using the sequence of the randomisation table, by a third person in clinic prior to surgery.
Blinding of participants and personnel (performance bias)	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described.

Pahlitzsch 2018 *(Continued)*

All outcomes		
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Pajic 2017

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 130 Number of eyes included: 130 Country: Switzerland Average age: 70 years laser arm, 70 years control arm Sex: 52% females laser arm, 60% females control arm Ethnic group: not described Inclusion criteria: eligibility to undergo lens extraction by phacoemulsification followed by IOL implantation, an ability to complete patient interface docking with the femtosecond laser, an age of 50 years of older, willingness and ability to return for scheduled follow-up examination, and no current infections Exclusion criteria: minimal and maximal K-values of the central 3 mm zone that differ by more than 5D on topographic map of the cornea, a maximum K-value that exceeds 50D, a minimum K-value of less than 37D, corneal disease or pathology, such as corneal scaring or opacity, that precludes the transmission of laser wavelength or that distorts laser light, poorly dilating pupils of less than 6 mm or any other defect of the pupil that prevents the iris from adequate refraction peripherally, manifest glaucoma and ocular hypertension, and pseudoexfoliation. Additionally, any systemic or ocular pathology or previous ocular surgery was also excluded.
Interventions	Laser-assisted cataract surgery using the Femto LDV Z8 (Ziemer Ophthalmic Systems AG, Port, Switzerland) or manual phacoemulsification using a device Catharex 3 system (Oertli Instrumente AG, Berneck, Switzerland)
Outcomes	Primary outcome measures: best corrected visual acuity (BCVA) up to 3 months after surgery, effective phacoemulsification time (EPT, seconds) and complications Additional data reported: mean phacoemulsification time
Notes	Funding source: not reported Declaration of interest: the authors declare no conflicts of interest Date study conducted: January 2015 to September 2016 Trial registration number: not reported

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	The method of sequence generation is not described.

Pajic 2017 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Low risk	30 eyes were included and analysed up until 3 months postoperatively.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Panthier 2017

Study characteristics	
Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 33 Number of eyes included: 66 (33 laser arm, 33 control arm) Country: France Average age: not reported Sex: not reported Ethnic group: not reported Inclusion criteria: not reported Exclusion criteria: patients with one eye or poor pupil dilation
Interventions	Femtosecond laser cataract surgery (Bausch & Lomb Victus) vs manual phacoemulsification cataract surgery (no manufacturer details given)
Outcomes	Capsulotomy parameters, effective lens position, refractive error, corrected distance visual acuity
Notes	Funding source: no specific funding Declaration of interest: the authors have no financial or proprietary interest in the materials presented Date study conducted: May 2012 to June 2012 Trial registration number: not reported

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Panthier 2017 *(Continued)*

Random sequence generation (selection bias)	Unclear risk	*"One eye was randomly included in the FLACS group and the other in the conventional phacoemulsification cataract surgery (CPCS) group, regardless of the side or order of surgery."*
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	For rhexis parameters: *"analysed by a single operator, ignoring the surgical procedure".*
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Parra-Rodríguez 2016

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 100 (50 laser arm, 50 control arm) Number of eyes included: 100 (50 laser arm, 50 control arm) Country: Mexico Average age: 62.9 years, breakdown by arm given by histogram in manuscript Sex: 60% female overall, no breakdown by arm presented Ethnic group: not described Inclusion criteria: not described Exclusion criteria: non-age related cataract, endothelial count lower than 1500 cells/mm^2 and incomplete post-surgical history and clinical history
Interventions	Standard technique with Infiniti and Centurion platforms by Alcon. Femtosecond with Alcon LensX platform. The surgical procedure was continued with the Infiniti and Centurion platforms of Alcon.
Outcomes	Endothelial cell count, coefficient of variation and hexagonality
Notes	Funding source: no sponsorship of any kind was received to carry out this study Declaration of interest: the authors declare no conflict of interest Date study conducted: not reported Trial registration number: not reported

Parra-Rodríguez 2016 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not described.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Pedroza 2016

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 65 (35 laser arm, 30 control arm) Number of eyes included: 65 (35 laser arm, 30 control arm) Country: Mexico Average age: 67 years laser arm, 72 years control arm Ethnic group: not described Inclusion criteria: older than 45 years, without corneal disease, good pupil dilation Exclusion criteria: previous ocular surgery
Interventions	Laser assisted cataract surgery vs manual phacoemulsification cataract surgery (Alcon)
Outcomes	Endothelial cell count, central corneal thickness, phacoemulsification parameters
Notes	Funding source: no specific funding Declaration of interest: the authors declare that they have no conflict of interest Date study conducted: not described Trial registration number: not reported

Pedroza 2016 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Balanced blocks".
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Reddy 2013

Study characteristics

Methods	Parallel-group RCT
Participants	Number of participants randomised: 131 Number of eyes: 131 Country: India Average age: 59 years laser arm, 61 control arm Sex: 46% female laser arm, 41% female control arm Ethnic group: not described Inclusion criteria: eligible patients were at least 18 years old with clear corneal media and elected to have routine cataract surgery Exclusion criteria for all patients: • Poorly dilating pupil or other pupil defect that prevents iris from adequate retraction peripherally • Lens/zonule instability such as, but not restricted to, Marfan syndrome, pseudoexfoliation syndrome • Previous intraocular or corneal surgery of any kind, including any kind of surgery for refractive or therapeutic purposes in either eye • Known sensitivity to planned concomitant medications • Disorders of the ocular muscle, such as nystagmus or strabismus • Keratoconus

Reddy 2013 *(Continued)*

	• Wound-healing disorders, such as connective tissue disease, autoimmune illnesses, immunodeficiency illnesses, ocular herpes zoster or simplex, endocrine diseases, lupus, rheumatoid arthritis • Abnormal examination results from slitlamp, fundus, partial coherence interferometry • Autoimmune disease, collagenosis or clinically significant atopy • Pregnancy or nursing Additional exclusion criteria for those having laser-assisted procedures: • Minimal and maximal K values in central 3.0 mm zone that do not differ by more than 5.0 D on a keratometric map of the cornea • Maximal K-value that does not exceed 60.0 D and minimum value that is smaller than 37.0 D • Corneal disease or pathology that precludes transmission of laser wavelength or distortion of laser light • Abnormal examination results from scanning-slit corneal topography • Anterior chamber depth < 2.4 mm or > 4.5 mm measured by ultrasonic examination The study enrolled 131 patients (laser group, 64; manual group, 67)
Interventions	Surgical intervention: laser-assisted cataract surgery using the VICTUS™ platform (Bausch & Lomb Technolas) or manual phacoemulsification using the Stellaris Vision Enhancement System (Bausch & Lomb)
Outcomes	Primary outcome measure: effective phacoemulsification time Secondary outcome measures: mean phacoemulsification energy, mean phacoemulsification time, volume of balanced salt solution, subjective surgeon assessment of ease of phacoemulsification Additional data reported: capsulotomy comparisons, intraocular lens decentration, safety data including posterior capsule tear and iris damage Follow-up was limited to 1 day postoperatively
Notes	Funding source: not reported Declaration of interest: *"Dr. Reddy has received travel and research grants from Technolas Perfect Vision GmbH, Dr. Kandulla is an employee of Technolas Perfect Vision GmbH (a Bausch & Lomb company), and Dr. Auffarth has received travel and research grants as well as lecture fees from Technolas Perfect Vision GmbH/Bausch & Lomb"* Date study conducted: not reported Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not described.
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not described, other than "open-label".
Blinding of outcome assessment (detection bias) All outcomes	High risk	Not described, other than "open-label".

Reddy 2013 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	High risk	One eye in the laser-assisted group was excluded from analysis because of a protocol violation (no details of this are given). Also: *"During the clinical trial, it became evident that the P values of all phacoemulsification parameters (EPT, mean phaco energy, mean phaco time, and balanced salt solution volume) were both surgeon dependent and cataract grade dependent. Evaluation by the Mann-Whitney U test showed that median cataract grade between the 2 treatment groups was equal except for those operated on by 1 surgeon. To ensure equal cataract grade distributions in the 2 study groups to guarantee correct data analysis and rule out preoperative bias, 7 eyes in the laser-assisted group and 4 in the manual group were excluded from further analysis. This resulted in 56 eyes in the laser-assisted group and 63 in the manual group that had subsequent analysis*".
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Roberts 2019

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 400 Number of eyes included: 400 Country: United Kingdom Average age: 70 years laser arm, 71 years control arm Sex: 50% females laser arm, 59% females control arm Ethnic group: not described Inclusion criteria: patients must have reduced visual acuity or visual symptoms attributed to the presence of cataract in 1 or both eyes by the examining ophthalmologist or must require cataract surgery on clinical grounds other than visual symptoms, patients must be willing to attend follow-ups 3 to 4 weeks after cataract surgery, patients must have sufficient English language for informed consent and completion of the patient-reported outcome questionnaires Exclusion criteria: children below the age of 18, those already enrolled in another study, clinical contraindications for femtosecond laser–assisted cataract surgery, such as: significant corneal opacities, small pupils (< 4.0 mm) after pharmacological dilatation, patients unable to lie sufficiently flat so as to be positioned underneath the laser machine
Interventions	Laser-assisted cataract surgery using the LenSx (Alcon Laboratories Inc) or manual phacoemulsification using the Infinity Vision System (Alcon Laboratories, Inc.)
Outcomes	Primary outcome measures: the UDVA at 4 weeks Additional data reported: intraoperative and postoperative complications, refraction, corneal thickness, and endothelial cell loss, with quality of life outcomes and patient-reported quality of vision preoperatively and at 4 weeks postoperatively
Notes	Funding source: supported by a research grant from Alcon Laboratories, Inc. (no. IIT #17440075), Fort Worth, Texas, USA. The funding organisation had no role in the design or conduct of this research Declaration of interest: Dr. O'Brart has been a consultant to Sooft Italia SPA and Alcon Laboratories, Inc. None of the other authors has a financial or proprietary interest in any material or methods mentioned. Date study conducted: August 2016 to June 2017 Trial registration number: not reported
Risk of bias	

Roberts 2019 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Patients were randomised to receive PCS or femtosecond laser–assisted cataract surgery in equal proportions using computer-generated random number tables.
Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Visual acuity and any investigations performed (corneal topography, specular microscopy, etc.) were conducted by an optometrist or technician masked to the participant's treatment arm.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Although losses to follow-up were unequal between the arms, the high overall rate of follow-up of 97.8% suggests that possible biases resulting from unequal follow-ups are unlikely to be important.
Selective reporting (reporting bias)	Low risk	The outcomes of interest were reported in the prespecified way in both the protocol and in the published report.

Schargus 2015

Study characteristics	
Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 37 Number of eyes included: 74 Country: Germany Average age: 72 years Sex: 59% female Ethnic group: not described Inclusion criteria: had a visually significant cataract (NC2 to NC5 on the Lens Opacities Classification System III (LOCS III)), corrected distance visual acuity (CDVA) decreased 0.1 logMAR in both eyes, dilated pupil width of 6.0 mm or greater, and were willing to volunteer for the trial after giving informed consent Exclusion criteria: corneal scars, corneal diseases, corneal astigmatism of 1.5 D or greater, reduced endothelial cell count (ECC) (less than 1500 cells/mm^2), CCT less than 500 µm, glaucoma, pseudoexfoliation syndrome, zonular weakness, single eye, malformations, history of ocular surgery, intraocular tumours, active or past inflammations, age-related macular degeneration, diabetic retinopathy, axial length difference (greater than 0.5 mm) and axial length less than 21.5 mm or greater than 26 mm, pregnancy, reduced compliance, age younger than 22 years, or participation in another clinical study within 30 days of the preoperative visit

Schargus 2015 *(Continued)*

Interventions	Laser-assisted cataract surgery using the Catalys platform (Catalys Precision Laser System, AMO) or manual phacoemulsification using a Stellaris phaco machine (Bausch & Lomb)
Outcomes	Primary outcome measure: endothelial cell count before surgery and 3 and 6 months postoperatively Secondary outcome measurements included evaluation of corneal thickness, intraocular pressure, CDVA, overall surgery time and quantity of fluid passing through the eye during surgery
Notes	Funding source: not reported Declaration of interest: *"Dr Dick is a paid consultant for Abbott Medical Optics. The remaining authors have no financial or proprietary interest in the materials presented"* Date study conducted: October 2012 to May 2013 Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Both treatment group allocations were printed on a separate sheet, which were sealed in sequentially numbered, identical envelopes according to the randomised allocation sequence.
Allocation concealment (selection bias)	Low risk	The enclosed assignments were inserted into sequentially numbered, opaque, well-sealed envelopes for allocation concealment, which were continuously monitored. Investigators ensured that the envelopes were opened sequentially and only after the participant's name and other details were written on the appropriate envelope.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of outcome assessment is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Schroeter 2021

Study characteristics

Methods	Parallel-group RCT
Participants	Number of participants randomised: 130 Number of eyes included: 130 Country: Switzerland

Schroeter 2021 *(Continued)*

	Average age: 71 years laser arm, 70 years control arm Sex: 53% females Ethnic group: not specified Inclusion criteria: the inclusion criteria required the presence of a clear cornea and the patient's age being 50 years or more. Another important point was the feasibility of attaching a docking system of the femtosecond laser with cataract extraction and fitting of a primary intraocular lens. The patient was to be willing and able to attend the scheduled follow-up examinations. Exclusion criteria: patients were excluded from the study when the minimum and maximum K-values of the central 3 mm corneal zone differed with more than 5 D, meaning that the steepest meridian should not exceed 48 D and, in particular, it should not be flatter than 37 D in the other meridian; all corneal diseases, such as corneal scarring, which could impede the transmission of the laser wavelength or distort the laser light were excluded; poorly dilated pupils or other pupillary defects were not considered for the study. In addition, other ocular diseases that led to the exclusion were manifest glaucoma, ocular hypertension, pseudoexfoliation and any kind of former corneal or lens surgery. Lens instability with respect to lentodonesis and keratoconic changes were not included. Furthermore, not all metabolic and autoimmune diseases were considered for the study. The anterior chamber depth (ACD) should not be less than 1.5 and greater than 4.8 mm. Patients who participated in other studies at the same time were also excluded.
Interventions	Laser-assisted cataract surgery using the Femto LDV Z8 (Ziemer Ophthalmic Systems AG, Port, Switzerland) or manual phacoemulsification using a device Catharex 3 system (Oertli Instrumente AG, Berneck, Switzerland)
Outcomes	Primary outcome measures: endothelial corneal cell density, coefficient of variation of endothelial cell area, percentage of hexagonal cells, effective phacoemulsification time, best corrected visual acuity, refraction with regards to mean absolute error, capsulotomy precision
Notes	Funding source: this research received no external funding Declaration of interest: the authors declare no conflict of interest Date study conducted: not specified Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Mechanism of randomisation not described.
Allocation concealment (selection bias)	Unclear risk	No mention of allocation concealment.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No masking of those assessing outcomes was described.

Schroeter 2021 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Low risk	Four patients in total, with 2 from the FLACS and 2 from the PCS group, were excluded from the study, as they did not show up for all postoperative examinations.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Schwarzenbacher 2020

Study characteristics	
Methods	Within-person (paired-eye) RCT
Participants	Number of participants randomised: 40 Number of eyes included: 80 Country: Austria Average age: 70 years Sex: 70% females Ethnic group: not specified Inclusion criteria: bilateral age-related cataract and a pupil size of 6.5 mm or larger Exclusion criteria: exclusion criteria were a history of inflammatory eye disease, previous ocular surgery or trauma, pseudoexfoliation, age-related macular degeneration, diabetic retinopathy, rheumatic disease and use of NSAIDs within 6 months before screening
Interventions	Laser-assisted cataract surgery using the Femto LDV Z8 (Ziemer Ophthalmic Systems AG, Port, Switzerland) or manual phacoemulsification (platform not stated)
Outcomes	Primary outcome measures: IL-1b, IL-6, and total PG concentrations in anterior chamber aqueous humour
Notes	Funding source: L. Schwarzenbacher is a recipient of a DOC Fellowship of the Austrian Academy of Sciences (Award Number 25082) Declaration of interest: the authors report no conflicts of interest in this work Date study conducted: not provided Trial registration number: not reported

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Before the investigation started, a randomisation list was generated with Datinf Randlist software A (version 2.0, Datinf GmbH, Tubingen, Germany).
Allocation concealment (selection bias)	Low risk	Sequentially numbered, sealed envelopes (provided by an investigator with no clinical involvement in the trial) were opened by the surgeon on the day of surgery.

Schwarzenbacher 2020 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. Patients were masked to the surgery.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Patients and investigators were masked to the surgery type.
Incomplete outcome data (attrition bias) All outcomes	Low risk	None of the patients were lost to follow-up.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Schweitzer 2020

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 870 Number of eyes included: 1389 Country: France Average age: 72 years laser arm, 72 years control arm Sex: 62% females laser arm, 63% males control arm Ethnic group: not specified Inclusion criteria: included all consecutive patients eligible for a unilateral or bilateral cataract surgery aged 22 years or older with the ability to give informed consent. All participants provided written informed consent for enrolment in the study. Surgery was proposed when cataract was responsible for a best-corrected visual acuity (BCVA) worse than 0.3 LogMAR or for cataract-related severe visual disturbance, such as halos, glare, or severe photophobia. Exclusion criteria: insufficient iris dilation (less than or equal to 6 mm), irido-crystalline synechiae, zonular instability diagnosed preoperatively, crystalline lens sub-luxation or luxation, obstructive corneal opacities or obstructive pterygium, known amblyopia, axial length 1.5 dioptres, patient not eligible for the implant model used by the centre, history of Fuchs endothelial dystrophy, ophthalmological history of central retinal vein occlusion, ophthalmological history of optic neuropathy, ophthalmological history of retinal detachment or congenital or acquired progressive retinal pathologies, ophthalmological history of uveitis, progressive glaucoma, nystagmus, general history of dementia or psychosis, uncontrolled diabetes, intake of systemic carbonic anhydrase inhibitors, history of systemic alpha-blockers intake, for unilateral cataracts - history of cataract surgery with complications on the first eye, or chromophore implant different from that selected for study in the centre, pregnant, breastfeeding women, or women of childbearing age, without effective contraception (oestrogen-progestin, intrauterine device (IUD)), the patient will not be included in the study for unilateral surgery if the second eye is not included and requires cataract surgery within 4 months after the inclusion of the first eye, physical or mental inability of the patient, according to the investigator, to settle adequately under the laser, persons placed under judicial protection, participant participating in another research including an exclusion period still in progress at pre-inclusion
Interventions	Laser-assisted cataract surgery using the Catalys platform (Abbott Medical Optics, Inc.) or manual phacoemulsification (phacoemulsification system not described)
Outcomes	Primary outcome measures: the primary clinical outcome measure was the difference between the 2 treatment arms in the proportion of eyes classified as having treatment success. Treatment success was a composite of all 4 of the following events at 3 months: (1) absence of severe intraoperative or postoperative complications up to month 3; (2) a BCVA of 0.0 LogMAR or better; (3) an absolute mani-

Schweitzer 2020 *(Continued)*

	fest refractive error of 0.75 dioptres or less; and (4) postoperative changes in corneal astigmatism power of 0.5 dioptres or less and astigmatism axis of 20° or less. Additional data reported: incremental cost-effectiveness ratio (ICER) for FLACS versus PCS, mean surgery time, mean total ultrasound time, mean cumulative dissipated energy, mean aspiration time, volume of BSS used during surgery, central corneal thickness, endothelial cell count, IOP, Tyndall – number of cells, central macular thickness, peripapillary retinal nerve fibre layer thickness
Notes	Funding source: this study was supported by a grant from the French Ministry of Social Affairs and Health Declaration of interest: CS has had advisory roles (compensated) or honoraria for lecturing with Alcon, Allergan, Glaukos, Johnson & Johnson, Novartis, Théa, and Zeiss, outside of the submitted work. ABr has had advisory roles (compensated) and honoraria for lecturing with Alcon, outside of the submitted work. BC is past president of the French Society of Ophthalmology (SFO), past president of the European Society of Cataract and Refractive Surgery, is currently the president of the French Academy of Ophthalmology, and has had advisory roles (compensated) or honoraria for lecturing with Alcon, Cutting Edge Pharma Technologies, Hoya Vision, Hours Pharma, Johnson & Johnson, Santen Pharmaceutical, Théa, and Zeiss, outside of the submitted work. PD is past president of the SFO and is currently the president of the French Glaucoma Society. P-JP is the past president of the SFO and has had advisory roles (compensated) or honoraria for lecturing with Alcon, Novartis, Santen Pharmaceutical, Shire, and Théa, outside of the submitted work. All other authors declare no competing interests. Date study conducted: October 2013 to October 2015 Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Permuted-block randomisation (block size of 2 or 4 for unilateral cases and 2 or 6 for bilateral cases, allocation 1:1) stratified on centres and type of cataract surgery (unilateral or bilateral) was done within the 5 days before surgery with a centralised web-based system.
Allocation concealment (selection bias)	Unclear risk	Permuted-block randomisation (block size of 2 or 4 for unilateral cases and 2 or 6 for bilateral cases, allocation 1:1) stratified on centres and type of cataract surgery (unilateral or bilateral) was done within the 5 days before surgery with a centralised web-based system.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. Participants were masked to the surgical treatment allocation until the last follow-up visit at 12 months after surgery, and a sham laser procedure was set up in the operating room for participants randomly assigned to the PCS arm.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All outcome assessors and the trained technicians who examined patients were also masked to the surgical treatment allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Figure 1 clearly outlines the number of patients who had procedures done and the number followed up. Those lost to follow-up were accounted for.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Takacs 2012

Study characteristics

Takacs 2012 *(Continued)*

Methods	Parallel-group RCT
Participants	Number of participants randomised: 76 (38 per arm) Number of eyes: 76 Country: Hungary Average age: 67 years laser arm, 67 years control arm Sex: 74% female laser arm, 61% female manual phacoemulsification arm Ethnic group: not described Inclusion criteria: only exclusion criteria stated Exclusion criteria: *"Patients showing low cooperation, dense (grade 4) or white cataract, corneal scars or opacities, anterior segment abnormalities, floppy iris syndrome, and poor pupillary dilation were not included in the study"*
Interventions	Laser-assisted cataract surgery using the LenSx femtosecond laser (Alcon Laboratories Inc) or manual phacoemulsification using the Alcon Infinity phacoemulsification system (Alcon Laboratories Inc)
Outcomes	Postoperative central corneal oedema, endothelial cell count and endothelial cell function expressed by volume stress index
Notes	Funding source: not reported Declaration of interest: *"Drs Nagy and Knorz are consultants to Alcon LenSx Inc. The remaining authors have no financial interest in the materials presented herein"* Date study conducted: February 2010 to February 2011 Trial registration number: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Patients were randomly assigned (using computer randomisation) to either group by the surgeon (ZZN)
Allocation concealment (selection bias)	Unclear risk	No further details other than above
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Examiners were not aware of which surgical procedure had been used when performing the postoperative examinations.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Vasvada 2019

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 182 Number of eyes included: 182 Country: India Average age: 67 years laser arm, 64 years control arm Sex: not described Ethnic group: not described Inclusion criteria: patients undergoing surgery for age-related cataract and a shallow AC, defined as an anterior chamber depth (ACD) less than 2.5 mm, nuclear cataracts grade 1 to 4 (NO (nuclear opalescence)/NC (nuclear colour), LOCS III) were included Exclusion criteria: small pupil that precluded FLACS, coexisting ocular comorbidities (e.g. Fuchs endothelial dystrophy, glaucoma) and previous ocular surgery/trauma
Interventions	Laser-assisted cataract surgery using the LenSx (Alcon Laboratories Inc) or manual phacoemulsification using the Alcon Centurion System (Alcon Laboratories, USA)
Outcomes	Primary outcome measures: central corneal thickness (CCT) Additional data reported: corneal clarity, AC cells and flare, endothelial cell density (ECD), coefficient of variance, hexagonality and uncorrected distance visual acuity (UDVA)
Notes	Funding source: not reported Declaration of interest: none of the authors has a financial or proprietary interest in any material or method mentioned Date study conducted: January 2017 to December 2017 Trial registration number: not reported

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomisation was done on the day of surgery using a computerised, random number generator.
Allocation concealment (selection bias)	Unclear risk	Randomisation was done on the day of surgery using a computerised, random number generator.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of patients is described.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	A single masked observer recorded all the observations at each visit.
Incomplete outcome data (attrition bias) All outcomes	Low risk	The study comprised 182 eyes (91 eyes in Group 1 and 91 eyes in Group 2) that completed the 6 months of follow-up.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Yu 2015

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 36 Number of eyes: 54 Country: China Average age: 62 years laser arm, 57 years control arm Sex: not described Ethnic group: not described Inclusion criteria: normal and transparent cornea; pupillary diameter of at least 6 mm under dilation; preoperative best corrected visual acuity worse than LogMAR 0.3 Exclusion criteria: no local or systematic contraindications for cataract surgery
Interventions	Laser-assisted cataract surgery using the LENSAR femtosecond laser or manual phacoemulsification using the Bausch & Lomb Stellaris system
Outcomes	Phacoemulsification time, energy and complications during operation were recorded. Postoperative refraction at 1 day, 1 week, 1 and 3 months, the capsulorhexis size and corneal endothelial density at 1 and 3 months were also measured
Notes	Funding source: funded by the International Cooperation Project of the Science and Technology Bureau of Zhejiang province, China (Grant No. 2013C14010) Declaration of interest: *"All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported"* Date study conducted: October 2013 to November 2013 Trial registration number: not reported

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Not described.
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Corneal endothelial cell density and capsulorhexis size were measured by a masked examiner. No masking of other outcomes is described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.

Yu 2015 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

Yu 2016

Study characteristics

Methods	Parallel-group RCT
Participants	Number of participants randomised: 30 patients: 13 laser, 17 control Number of eyes: 39 eyes (19 laser, 20 control) Country: China Mean (SD) age: 64 (11.2) years laser arm, 71 (11.7) years control arm Sex: 46% female laser arm (6F/7M), 53% female control arm (9F/8M) Ethnic group: not described Inclusion criteria: normal corneas and dilated pupillary diameter greater than 6 mm Exclusion criteria: previous ocular trauma or surgery, and any local or systemic abnormalities other than cataract, such as extensive corneal scarring, pseudoexfoliation syndrome, glaucoma, ocular inflammation, retinal abnormalities, infections and diabetes mellitus
Interventions	Laser-assisted cataract surgery using the LENSAR femtosecond laser or manual phacoemulsification using the Bausch & Lomb Stellaris system
Outcomes	Morphology of the cutting edge and cells of anterior capsule was assessed by light microscopy. The proteins in the aqueous humour were identified by mass spectrometry (Ultraflex III TOF/TOF; Bruker Dalton, Bremen, Germany). Electrolyte in the aqueous humour was detected by a chemistry analyser (Aeroset Clinical Chemistry Analyzer; Abbott Laboratories, Abbott Park, IL, USA).
Notes	Funding source: this work was funded by the Zhejiang Provincial Natural Science Foundation of China (Grant No. Y2110784), Zhejiang Provincial Foundation of China for Distinguished Young Talents in Medicine and Health (Grant No. 2010QNA018), and International Cooperation Project of the Science and Technology Bureau of Zhejiang province, China (Grant No. 2013C14010) Declaration of interest: no declaration given Date study conducted: 21 October to 20 November 2013 Trial registration number: NCT02492659

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not described.
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of participants and personnel (performance bias)	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.

Yu 2016 *(Continued)*

All outcomes		
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessments were masked.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	Enrollment on clinicaltrials.gov states 54 enrolled (unclear if eyes or patients); data reported on 39 eyes of 20 patients.

Zhang 2016

Study characteristics	
Methods	Parallel-group RCT
Participants	Number of participants randomised: 233 Number of eyes: 314 (153 eyes laser assisted cataract surgery, 161 eyes manual phacoemulsification cataract surgery) Country: China Average age: 65 years laser arm, 67 years control arm Sex: 53% female laser arm, 51% female manual phacoemulsification control arm Ethnic group: not described, presumed Chinese Inclusion criteria: not described Exclusion criteria: glaucoma, corneal disease, strabismus and nystagmus, small pupil, lens subluxation, retinopathy and other eye diseases based on the severity of the disease. Previous ocular trauma or surgery. For femtosecond laser arm: also Pentacam anterior chamber depth < 2.4 mm and patients with small palpebral fissure and deep fossa.
Interventions	Laser assisted cataract surgery (Alcon LenSx) vs manual phacoemulsification cataract surgery (Alcon Infiniti)
Outcomes	Phacoemulsification parameters, capsulotomy diameter and circularity, corneal endothelial cell loss, postoperative anterial chamber flare, complications
Notes	Funding source: not reported Declaration of interest: not reported Date study conducted: April to November 2013 Trial registration number: not reported
Risk of bias	

Bias	**Authors' judgement**	**Support for judgement**

Zhang 2016 *(Continued)*

Random sequence generation (selection bias)	Unclear risk	Not described.
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Surgeon masking is not feasible for the study methodology described. No masking of participants is described.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There is no reporting of data attrition to permit judgement.
Selective reporting (reporting bias)	Unclear risk	No access to study protocol or trials registry entry (trial was not registered).

BCVA: best-corrected visual acuity
BSS: balanced salt solution
CDVA: corrected distance visual acuity
CCT: central corneal thickness
D: dioptres
ECC: endothelial cell count
ECD: endothelial cell density
FLACS: femtosecond laser-assisted cataract surgery
IOL: intraocular lens
PCS: phacoemulsification cataract surgery
RCT: randomised controlled trial
UDVA: uncorrected distance visual acuity

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Chen 2022	Not a RCT
Conrad-Hengerer 2012a	Not a RCT
Conrad-Hengerer 2013b	Not a RCT
Conrad-Hengerer 2014b	Not a RCT
Ecsedy 2011	Not a RCT
Espaillat 2016	Not a RCT
Ganesh 2020	Not a RCT
Hatch 2015	Not a RCT
Kerr 2013	Not a RCT

Study	Reason for exclusion
Krarup 2014	Although this is a within-person paired-eye study, eyes were not randomised to the intervention (*"To evaluate whether FLACS was superior to CPS regarding ECL, the eye with most dense cataract was operated with femtosecond laser assisted cataract surgery and the eye with less cataract with conventional cataract surgery"*)
Kránitz 2011	Not a RCT
Nagy 2012	Insufficient information to confirm eligibility (conference abstract only); no mention of randomisation to the intervention
Pisciotta 2018	Not a RCT
Ranjini 2017	Not a RCT
Szigeti 2012	Both arms involved laser-assisted cataract surgery; no phacoemulsification control arm
Toto 2015	Not a RCT
Vasquez-Perez 2018	Not a RCT
Wang 2015	Unable to source a copy of the paper from either the journal website or the contact author
Whang 2018	Not a RCT

FLACS: femtosecond laser-assisted cataract surgery; RCT: randomised controlled trial

Characteristics of ongoing studies *[ordered by study ID]*

NCT01693211

Study name	Prospective evaluation of circularity and diameter of femtosecond laser versus manual anterior capsulotomy in Singapore National Eye Centre
Methods	Allocation: randomised Endpoint classification: efficacy study Intervention model: parallel assignment Masking: open-label Primary purpose: treatment
Participants	48
Interventions	Device: femtosecond laser (VICTUS™ femtosecond laser platform) Device: manual phacoemulsification cataract surgery (continuous curvilinear capsulorhexis technique with Utrata forceps)
Outcomes	Primary outcome measure: circularity of created rhexis Secondary outcome measure: diameter of the created rhexis Other outcome measure: centration of the created rhexis relative to the pupil
Starting date	September 2012
Contact information	Principal investigator: Soon Phaik Chee, Assoc Prof, Singapore National Eye Center
Notes	Study completion date: June 2014

NCT01693211 *(Continued)*	
	CT.gov website checked on 22 June 2022, no study results posted

NCT01769313	
Study name	A single centre study to analyze cataract surgery following femtosecond laser-assisted and manual cataract surgery
Methods	Allocation: randomised Endpoint classification: efficacy study Intervention model: parallel assignment Masking: single-blind (caregiver) Primary purpose: treatment
Participants	30
Interventions	Device: laser-assisted cataract surgery Device: manually performed cataract surgery
Outcomes	Capsulotomy overlap, effective lens position, difference in pre- to postoperative flare, refractive outcome prediction error
Starting date	January 2013
Contact information	Principal investigator: Gerd U Auffarth, Prof. Universitäts-Augenklinik Heidelberg
Notes	Study completion date: October 2014 CT.gov website checked on 22 June 2022, no study results posted

NCT01971177	
Study name	A multi-centre, multi-surgeon, randomised, controlled, prospective, post-market clinical follow-up study to investigate the impact of cataract grade on the efficacy and safety of femtosecond laser-assisted lens fragmentation procedure
Methods	Allocation: randomised Endpoint classification: safety/efficacy study Intervention model: parallel assignment Masking: open-label Primary purpose: treatment
Participants	136
Interventions	Device: femtosecond laser cataract surgery Procedure: manual cataract surgery
Outcomes	Primary outcome measures: effective phacoemulsification time Secondary outcome measures: adverse events
Starting date	October 2013
Contact information	Principal investigator: Pavel Stodulka, Dr. med Gemini clinic, Zlin, Czech Republic 76001

NCT01971177 *(Continued)*

Notes	Study completion date: February 2014 CT.gov website checked on 22 June 2022, no study results posted

NCT02110212

Study name	A prospective, randomised study of cataract surgery with the assistance of the OptiMedica femtosecond laser system compared to standard surgical procedure of continuous curvilinear capsulorhexis and ultrasonic phacoemulsification
Methods	Allocation: randomised Endpoint classification: safety/efficacy study Intervention model: parallel assignment Masking: open-label Primary purpose: treatment
Participants	17
Interventions	Procedure: ultrasound surgery and continuous curvilinear capsulorhexis Device: femtosecond laser surgery
Outcomes	Primary outcome measure: capsulotomy dimension Secondary outcome measure: cumulative dissipated energy
Starting date	April 2011
Contact information	Principal investigator: Juan F. Batlle, Laser Center, Santo Domingo, Dominican Republic
Notes	Study completion date: February 2014 No study results posted: this study has been terminated

NCT02403206

Study name	Femtosecond laser assisted cataract surgery in intumescent cataracts
Methods	Allocation: randomised Endpoint classification: safety study Intervention model: parallel assignment Masking: open-label Primary purpose: treatment
Participants	425
Interventions	Device: femtosecond laser Procedure: continuous curvilinear capsulorhexis
Outcomes	Primary outcome measure: percentage of capsular tears (anterior or posterior) Secondary outcome measure: operating time
Starting date	March 2015

NCT02403206 *(Continued)*

Contact information	Study director: Kristi Rushin, Alcon Research
Notes	Estimated study completion date: August 2016 CT.gov website checked on 22 June 2022, no study results posted

NCT02561104

Study name	Outcomes of resident-performed laser-assisted versus manual traditional phacoemulsification
Methods	Allocation: randomised Endpoint classification: safety/efficacy study Intervention model: parallel assignment Masking: open-label Primary purpose: treatment
Participants	180
Interventions	Procedure: laser-assisted cataract surgery Procedure: traditional manual phacoemulsification
Outcomes	Primary outcome measures: • complication rates • bilateral best spectacle corrected visual acuity Secondary outcome measures: • patient benefit perception • corneal endothelial cell count • lens removal time
Starting date	September 2015
Contact information	Bonnie Miller, University of Texas Southwestern Medical Center
Notes	Estimated study completion date: January 2017

NCT02974140

Study name	A prospective, multicenter, randomized evaluation of refractive predictability in patients with or without corneal astigmatism (maximum allowable up to 1.25D) when using the cataract refractive suite and standard manual techniques
Methods	Allocation: randomised Intervention model: parallel assignment Masking: outcomes assessor Primary purpose: treatment
Participants	39

NCT02974140 *(Continued)*

Interventions	• Device: Cataract Refractive Suite (CRS) Configuration consisting of Verion™ Image Guided System, LenSx® Laser and ORA™ System with VerifEye+™ (with or without VerifEye Lynk), combined for use in surgical pre-op planning and during cataract surgery • Procedure: standard manual technique; standard biometry for intraocular lens (IOL) calculation and cataract removal using phacoemulsification technique
Outcomes	Primary outcome measures: Percentage of eyes in which the manifest refraction spherical equivalent (MRSE) at 1 month is ≤ 0.50 dioptre (D) relative to predicted MRSE (time frame: day 20 to 40 from second implantation) Secondary outcome measures: Cumulative dissipated energy (CDE) Estimated aspiration fluid used Phaco aspiration time
Starting date	2 March 2017
Contact information	Alcon
Notes	https://clinicaltrials.gov/ct2/show/study/NCT02974140

NCT03050008

Study name	Efficacy of FLACS USFREE compared to traditional surgery using ultrasound
Methods	Allocation: randomised Intervention model: parallel assignment Masking: no masking Primary purpose: treatment
Participants	53 operated eyes per group (106 eyes in total)
Interventions	• FLACS USFREE: cataract surgery with femtosecond laser without ultrasound • Traditional surgery: traditional phacoemulsification cataract surgery using ultrasound
Outcomes	Primary outcome: BSS volume difference observed between eyes submitted to FLACS USFREE versus traditional phacoemulsification with ultrasound surgery Secondary outcomes: • Difference in CDE between eyes submitted to FLACS USFREE versus traditional phacoemulsification with ultrasound surgery • Difference in time (in seconds) of phacoemulsification during surgery, between eyes submitted to FLACS USFREE versus traditional phacoemulsification with ultrasound surgery • Difference in endothelial cell counts 1, 7 and 30 days after cataract surgery between eyes submitted to FLACS USFREE versus traditional phacoemulsification with ultrasound • Difference in visual acuity presented 1, 7 and 30 days after cataract surgery between eyes submitted to FLACS USFREE versus traditional phacoemulsification with ultrasound • Difference in visual acuity with better correction 1, 7 and 30 days after cataract surgery between eyes submitted to FLACS USFREE versus traditional phacoemulsification with ultrasound surgery

NCT03050008 *(Continued)*	• Difference in corneal topography 1, 7 and 30 days after cataract surgery between eyes submitted to FLACS USFREE versus traditional phacoemulsification with ultrasound • Difference in corneal pachymetry 1, 7 and 30 days after cataract surgery, between eyes submitted to FLACS USFREE versus traditional phacoemulsification with ultrasound surgery • Difference in intraocular pressure 1, 7 and 30 days after cataract surgery between eyes submitted to FLACS USFREE versus traditional phacoemulsification with ultrasound surgery • Incidence of adverse events during the study period among study participants submitted to FLACS USFREE versus traditional phacoemulsification with ultrasound
Starting date	January 2016
Contact information	Alfredo Tranjan, MD
Notes	https://ClinicalTrials.gov/show/NCT03050008

CDE: cumulative dissipated energy
FLACS: femtosecond laser-assisted cataract surgery

DATA AND ANALYSES

Comparison 1. Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery

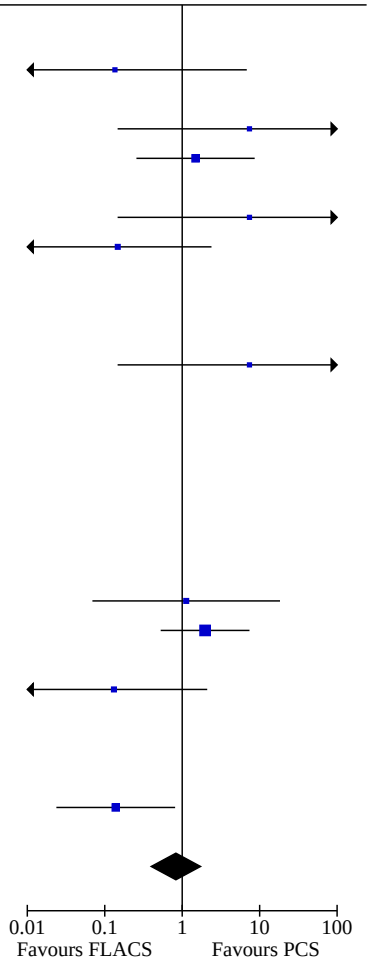
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1 Intraoperative complications: anterior capsule tears	27	5830	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.83 [0.40, 1.72]
1.2 Intraoperative complications: posterior capsule tears	26	5767	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.50 [0.25, 1.00]
1.3 Corrected distance visual acuity 1 week	4		Mean Difference (IV, Random, 95% CI)	Totals not selected
1.4 Corrected distance visual acuity 1 to 3 months	11	2791	Mean Difference (IV, Random, 95% CI)	-0.00 [-0.01, 0.01]
1.5 Corrected distance visual acuity 6 months or more	7	1323	Mean Difference (IV, Random, 95% CI)	-0.01 [-0.02, -0.00]
1.6 Uncorrected distance visual acuity 1 week	5		Mean Difference (IV, Random, 95% CI)	Totals not selected
1.7 Uncorrected distance visual acuity 1 to 3 months	9		Mean Difference (IV, Random, 95% CI)	Totals not selected
1.8 Uncorrected distance visual acuity 6 months or more	5		Mean Difference (IV, Random, 95% CI)	Totals not selected
1.9 Postoperative complications	19		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
1.9.1 Cystoid macular oedema	18	4441	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.84 [0.56, 1.28]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.9.2 Elevated intraocular pressure (up to 1 day after surgery)	10	1116	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.86 [0.29, 2.56]
1.9.3 Elevated intraocular pressure (1 day to 1 week after surgery)	11	1411	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.50 [0.10, 2.55]
1.9.4 Posterior capsule opacification	6	1413	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.81 [0.38, 1.73]
1.10 Endothelial cell loss	10	1512	Mean Difference (IV, Random, 95% CI)	12.24 [-39.99, 64.47]
1.11 Endothelial cell count final value	12	1836	Mean Difference (IV, Random, 95% CI)	24.18 [-20.06, 68.43]
1.12 Total duration of procedure	11		Mean Difference (IV, Random, 95% CI)	Totals not selected
1.13 Refractive outcomes - mean absolute error	6		Mean Difference (IV, Random, 95% CI)	Totals not selected

Analysis 1.1. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 1: Intraoperative complications: anterior capsule tears

Study or Subgroup	FLACS Events	FLACS Total	PCS Events	PCS Total	Weight	Peto Odds Ratio Peto, Fixed, 95% CI
Chee 2021	0	45	0	48		Not estimable
Conrad-Hengerer 2013 (1)	0	73	1	73	3.5%	0.14 [0.00 , 6.82]
Conrad-Hengerer 2014 (1)	0	104	0	104		Not estimable
Conrad-Hengerer 2015 (1)	1	100	0	100	3.5%	7.39 [0.15 , 372.38]
Day 2020	3	391	2	389	17.3%	1.49 [0.26 , 8.62]
Donnenfeld 2018	0	15	0	15		Not estimable
Dzhaber 2020 (1)	1	67	0	67	3.5%	7.39 [0.15 , 372.38]
Hansen 2020	0	64	2	71	6.9%	0.15 [0.01 , 2.39]
Hida 2017	0	200	0	200		Not estimable
Kovacs 2014	0	40	0	39		Not estimable
Kránitz 2012	0	20	0	25		Not estimable
Krarup 2021 (1)	1	34	0	34	3.5%	7.39 [0.15 , 372.38]
Liu 2021 (1)	0	78	0	78		Not estimable
Mursch-Edlmayr 2017 (1)	0	50	0	50		Not estimable
Nagy 2011	0	54	0	57		Not estimable
Nagy 2014	0	20	0	20		Not estimable
Pahlitzsch 2018	0	191	0	147		Not estimable
Pajic 2017	0	68	0	62		Not estimable
Panthier 2017 (1)	0	33	0	33		Not estimable
Reddy 2013	1	56	1	63	6.9%	1.13 [0.07 , 18.31]
Roberts 2019	6	200	3	200	30.8%	1.97 [0.53 , 7.39]
Schargus 2015 (1)	0	37	0	37		Not estimable
Schweitzer 2020	0	704	2	685	7.0%	0.13 [0.01 , 2.10]
Vasvada 2019	0	91	0	91		Not estimable
Yu 2015	0	25	0	29		Not estimable
Yu 2016	0	19	0	20		Not estimable
Zhang 2016	0	153	5	161	17.2%	0.14 [0.02 , 0.81]
Total (95% CI)		**2932**		**2898**	**100.0%**	**0.83 [0.40 , 1.72]**
Total events:	13		16			

Heterogeneity: Chi² = 13.66, df = 9 (P = 0.14); I² = 34%
Test for overall effect: Z = 0.50 (P = 0.62)
Test for subgroup differences: Not applicable

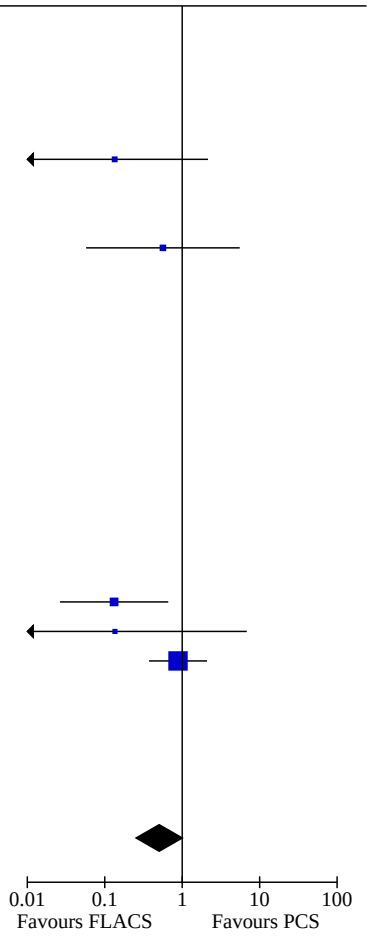


Footnotes
(1) Within-person (paired eye) study

Analysis 1.2. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 2: Intraoperative complications: posterior capsule tears

Study or Subgroup	FLACS Events	FLACS Total	PCS Events	PCS Total	Weight	Peto Odds Ratio Peto, Fixed, 95% CI
Chee 2021	0	45	0	48		Not estimable
Conrad-Hengerer 2013 (1)	0	73	0	73		Not estimable
Conrad-Hengerer 2014 (1)	0	104	0	104		Not estimable
Conrad-Hengerer 2015 (1)	0	100	0	100		Not estimable
Day 2020	0	391	2	389	6.1%	0.13 [0.01 , 2.15]
Donnenfeld 2018	0	15	0	15		Not estimable
Dzhaber 2020 (1)	0	67	0	67		Not estimable
Hansen 2020	1	64	2	71	9.1%	0.56 [0.06 , 5.53]
Hida 2017	0	200	0	200		Not estimable
Kovacs 2014	0	40	0	39		Not estimable
Kránitz 2012	0	20	0	25		Not estimable
Liu 2021 (1)	0	78	0	78		Not estimable
Mursch-Edlmayr 2017 (1)	0	50	0	50		Not estimable
Nagy 2011	0	54	0	57		Not estimable
Nagy 2014	0	20	0	20		Not estimable
Pahlitzsch 2018	0	196	0	147		Not estimable
Pajic 2017	0	68	0	62		Not estimable
Panthier 2017 (1)	0	33	0	33		Not estimable
Reddy 2013	0	56	0	63		Not estimable
Roberts 2019	0	200	6	200	18.2%	0.13 [0.03 , 0.66]
Schargus 2015 (1)	0	37	1	37	3.1%	0.14 [0.00 , 6.82]
Schweitzer 2020	10	704	11	685	63.5%	0.88 [0.37 , 2.09]
Vasvada 2019	0	91	0	91		Not estimable
Yu 2015	0	25	0	29		Not estimable
Yu 2016	0	19	0	20		Not estimable
Zhang 2016	0	153	0	161		Not estimable
Total (95% CI)		**2903**		**2864**	**100.0%**	**0.50 [0.25 , 1.00]**
Total events:	11		22			

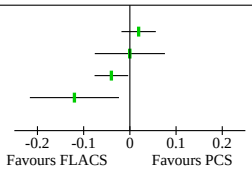
Heterogeneity: Chi² = 5.60, df = 4 (P = 0.23); I² = 29%
Test for overall effect: Z = 1.95 (P = 0.05)
Test for subgroup differences: Not applicable



Footnotes
(1) Within-person (paired eye) study

Analysis 1.3. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 3: Corrected distance visual acuity 1 week

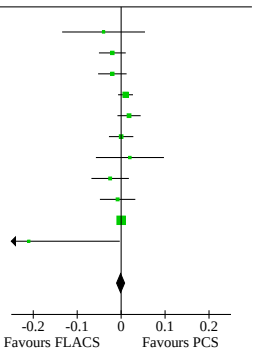
Study or Subgroup	FLACS Mean [logMAR]	FLACS SD [logMAR]	FLACS Total	PCS Mean [logMAR]	PCS SD [logMAR]	PCS Total	Mean Difference IV, Random, 95% CI [logMAR]
Hansen 2020	0.074	0.122	64	0.055	0.095	71	0.02 [-0.02 , 0.06]
Mastropasqua 2014a	0.19	0.15	30	0.19	0.15	30	0.00 [-0.08 , 0.08]
Mastropasqua 2014b	-0.03	0.1042	60	0.01	0.07	30	-0.04 [-0.08 , -0.00]
Yu 2015	0.06	0.15	25	0.18	0.21	29	-0.12 [-0.22 , -0.02]



Analysis 1.4. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 4: Corrected distance visual acuity 1 to 3 months

Study or Subgroup	FLACS Mean [logMAR]	FLACS SD [logMAR]	FLACS Total	PCS Mean [logMAR]	PCS SD [logMAR]	PCS Total	Weight	Mean Difference IV, Random, 95% CI [logMAR]
Chee 2021	0.21	0.16	23	0.25	0.24	48	0.9%	-0.04 [-0.13 , 0.05]
Day 2020	-0.01	0.19	352	0.01	0.21	316	7.6%	-0.02 [-0.05 , 0.01]
Donnenfeld 2018	0.01	0.04	15	0.03	0.05	15	6.8%	-0.02 [-0.05 , 0.01]
Filkorn 2012	0.03	0.06	77	0.02	0.04	57	18.2%	0.01 [-0.01 , 0.03]
Hansen 2020	0.047	0.093	64	0.029	0.057	71	9.6%	0.02 [-0.01 , 0.04]
Liu 2021 (1)	0.05	0.088318	78	0.05	0.088318	78	8.9%	0.00 [-0.03 , 0.03]
Mastropasqua 2014a	0.18	0.18	30	0.16	0.12	30	1.3%	0.02 [-0.06 , 0.10]
Mastropasqua 2014b	-0.085	0.0913	60	-0.06	0.1	30	4.2%	-0.03 [-0.07 , 0.02]
Schargus 2015 (1)	0.049	0.096	37	0.057	0.08	37	4.6%	-0.01 [-0.05 , 0.03]
Schweitzer 2020	0.02	0.08	663	0.02	0.05	656	37.7%	0.00 [-0.01 , 0.01]
Yu 2015	0.12	0.09	25	0.33	0.56	29	0.2%	-0.21 [-0.42 , -0.00]
Total (95% CI)			**1424**			**1367**	**100.0%**	**-0.00 [-0.01 , 0.01]**

Heterogeneity: Tau² = 0.00; Chi² = 12.62, df = 10 (P = 0.25); I² = 21%
Test for overall effect: Z = 0.27 (P = 0.79)
Test for subgroup differences: Not applicable

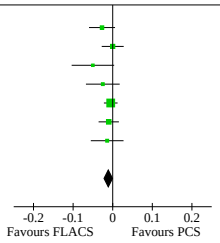


Footnotes
(1) Within-person (paired eye) study

Analysis 1.5. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 5: Corrected distance visual acuity 6 months or more

Study or Subgroup	FLACS Mean [logMAR]	FLACS SD [logMAR]	FLACS Total	PCS Mean [logMAR]	PCS SD [logMAR]	PCS Total	Weight	Mean Difference IV, Random, 95% CI [logMAR]	Risk of Bias A	B	C	D	E	F
Day 2020	0.003	0.18	292	0.03	0.23	311	10.8%	-0.03 [-0.06 , 0.01]	+	?	-	+	+	+
Liu 2021 (1)	0.05	0.088318	78	0.05	0.088318	78	15.1%	0.00 [-0.03 , 0.03]	+	?	-	-	+	?
Mastropasqua 2014a	-0.08	0.09	30	-0.03	0.12	30	4.0%	-0.05 [-0.10 , 0.00]	?	?	-	-	?	?
Mastropasqua 2014b	-0.085	0.0913	60	-0.06	0.1	30	6.4%	-0.03 [-0.07 , 0.02]	+	?	?	+	?	?
Oka 2021 (1)	-0.029	0.04	53	-0.024	0.05	53	39.1%	-0.01 [-0.02 , 0.01]	+	?	-	+	?	?
Roberts 2019	-0.01	0.1	116	0	0.1	118	17.7%	-0.01 [-0.04 , 0.02]	+	?	-	+	+	+
Schargus 2015 (1)	0.024	0.101	37	0.038	0.079	37	6.8%	-0.01 [-0.06 , 0.03]	?	+	-	-	?	?
Total (95% CI)			**666**			**657**	**100.0%**	**-0.01 [-0.02 , -0.00]**						

Heterogeneity: Tau² = 0.00; Chi² = 4.45, df = 6 (P = 0.62); I² = 0%
Test for overall effect: Z = 2.04 (P = 0.04)
Test for subgroup differences: Not applicable

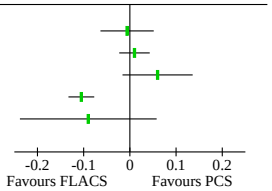


Footnotes
(1) Within-person (paired eye) study

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)

Analysis 1.6. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 6: Uncorrected distance visual acuity 1 week

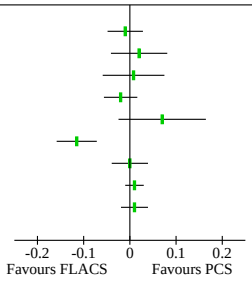
Study or Subgroup	FLACS Mean [logMAR]	FLACS SD [logMAR]	FLACS Total	PCS Mean [logMAR]	PCS SD [logMAR]	PCS Total	Mean Difference IV, Random, 95% CI [logMAR]
Hansen 2020	0.202	0.173	64	0.208	0.168	71	-0.01 [-0.06 , 0.05]
Liu 2021 (1)	0.19	0.1	78	0.18	0.11	78	0.01 [-0.02 , 0.04]
Mastropasqua 2014a	0.41	0.15	30	0.35	0.15	30	0.06 [-0.02 , 0.14]
Mastropasqua 2014b	0.075	0.0846	60	0.18	0.05	30	-0.10 [-0.13 , -0.08]
Vasvada 2019	0.18	0.31	91	0.27	0.65	91	-0.09 [-0.24 , 0.06]



Footnotes
(1) Within-person (paired eye) study

Analysis 1.7. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 7: Uncorrected distance visual acuity 1 to 3 months

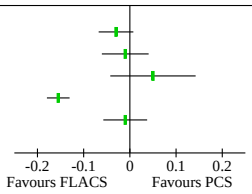
Study or Subgroup	FLACS Mean [logMAR]	FLACS SD [logMAR]	FLACS Total	PCS Mean [logMAR]	PCS SD [logMAR]	PCS Total	Mean Difference IV, Random, 95% CI [logMAR]
Day 2020	0.13	0.23	352	0.14	0.27	316	-0.01 [-0.05 , 0.03]
Donnenfeld 2018	0.13	0.09	15	0.11	0.08	15	0.02 [-0.04 , 0.08]
Hansen 2020	0.18	0.223	64	0.172	0.165	71	0.01 [-0.06 , 0.07]
Liu 2021 (1)	0.13	0.12	78	0.15	0.11	78	-0.02 [-0.06 , 0.02]
Mastropasqua 2014a	0.35	0.23	30	0.28	0.13	30	0.07 [-0.02 , 0.16]
Mastropasqua 2014b	0.095	0.1151	60	0.21	0.09	30	-0.11 [-0.16 , -0.07]
Roberts 2019	0.15	0.19	200	0.15	0.21	200	0.00 [-0.04 , 0.04]
Schweitzer 2020	0.14	0.19	660	0.13	0.18	649	0.01 [-0.01 , 0.03]
Vasvada 2019	0.1	0.09	91	0.09	0.11	91	0.01 [-0.02 , 0.04]



Footnotes
(1) Within-person (paired eye) study

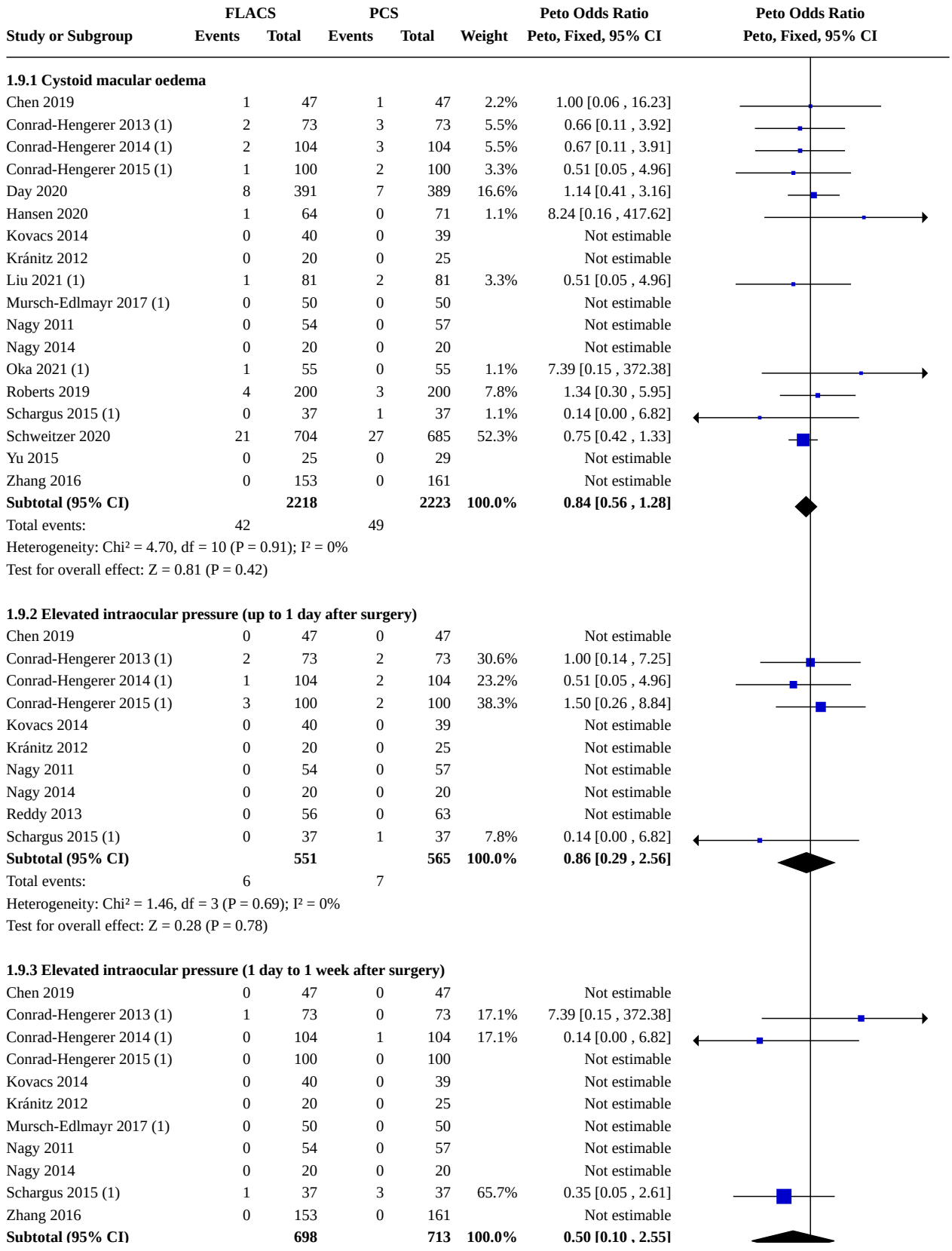
Analysis 1.8. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 8: Uncorrected distance visual acuity 6 months or more

Study or Subgroup	FLACS Mean [logMAR]	FLACS SD [logMAR]	FLACS Total	PCS Mean [logMAR]	PCS SD [logMAR]	PCS Total	Mean Difference IV, Random, 95% CI [logMAR]
Day 2020	0.14	0.22	292	0.17	0.25	311	-0.03 [-0.07 , 0.01]
Liu 2021 (1)	0.13	0.14	78	0.14	0.18	78	-0.01 [-0.06 , 0.04]
Mastropasqua 2014a	0.13	0.21	30	0.08	0.15	30	0.05 [-0.04 , 0.14]
Mastropasqua 2014b	0.095	0.0663	60	0.25	0.05	30	-0.15 [-0.18 , -0.13]
Roberts 2019	0.12	0.18	116	0.13	0.19	118	-0.01 [-0.06 , 0.04]



Footnotes
(1) Within-person (paired eye) study

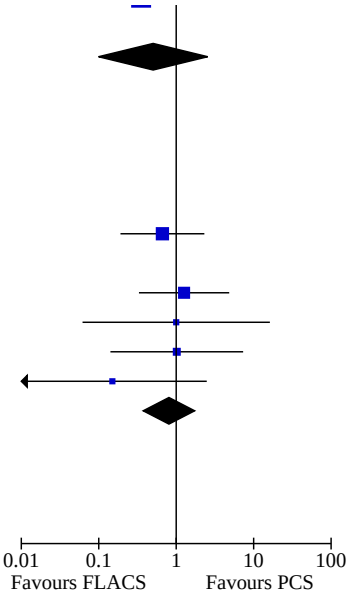
Analysis 1.9. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 9: Postoperative complications



Study or Subgroup	FLACS Events	FLACS Total	PCS Events	PCS Total	Weight	Peto Odds Ratio Peto, Fixed, 95% CI
1.9.1 Cystoid macular oedema						
Chen 2019	1	47	1	47	2.2%	1.00 [0.06 , 16.23]
Conrad-Hengerer 2013 (1)	2	73	3	73	5.5%	0.66 [0.11 , 3.92]
Conrad-Hengerer 2014 (1)	2	104	3	104	5.5%	0.67 [0.11 , 3.91]
Conrad-Hengerer 2015 (1)	1	100	2	100	3.3%	0.51 [0.05 , 4.96]
Day 2020	8	391	7	389	16.6%	1.14 [0.41 , 3.16]
Hansen 2020	1	64	0	71	1.1%	8.24 [0.16 , 417.62]
Kovacs 2014	0	40	0	39		Not estimable
Kránitz 2012	0	20	0	25		Not estimable
Liu 2021 (1)	1	81	2	81	3.3%	0.51 [0.05 , 4.96]
Mursch-Edlmayr 2017 (1)	0	50	0	50		Not estimable
Nagy 2011	0	54	0	57		Not estimable
Nagy 2014	0	20	0	20		Not estimable
Oka 2021 (1)	1	55	0	55	1.1%	7.39 [0.15 , 372.38]
Roberts 2019	4	200	3	200	7.8%	1.34 [0.30 , 5.95]
Schargus 2015 (1)	0	37	1	37	1.1%	0.14 [0.00 , 6.82]
Schweitzer 2020	21	704	27	685	52.3%	0.75 [0.42 , 1.33]
Yu 2015	0	25	0	29		Not estimable
Zhang 2016	0	153	0	161		Not estimable
Subtotal (95% CI)		**2218**		**2223**	**100.0%**	**0.84 [0.56 , 1.28]**
Total events:	42		49			
Heterogeneity: Chi² = 4.70, df = 10 (P = 0.91); I² = 0%						
Test for overall effect: Z = 0.81 (P = 0.42)						
1.9.2 Elevated intraocular pressure (up to 1 day after surgery)						
Chen 2019	0	47	0	47		Not estimable
Conrad-Hengerer 2013 (1)	2	73	2	73	30.6%	1.00 [0.14 , 7.25]
Conrad-Hengerer 2014 (1)	1	104	2	104	23.2%	0.51 [0.05 , 4.96]
Conrad-Hengerer 2015 (1)	3	100	2	100	38.3%	1.50 [0.26 , 8.84]
Kovacs 2014	0	40	0	39		Not estimable
Kránitz 2012	0	20	0	25		Not estimable
Nagy 2011	0	54	0	57		Not estimable
Nagy 2014	0	20	0	20		Not estimable
Reddy 2013	0	56	0	63		Not estimable
Schargus 2015 (1)	0	37	1	37	7.8%	0.14 [0.00 , 6.82]
Subtotal (95% CI)		**551**		**565**	**100.0%**	**0.86 [0.29 , 2.56]**
Total events:	6		7			
Heterogeneity: Chi² = 1.46, df = 3 (P = 0.69); I² = 0%						
Test for overall effect: Z = 0.28 (P = 0.78)						
1.9.3 Elevated intraocular pressure (1 day to 1 week after surgery)						
Chen 2019	0	47	0	47		Not estimable
Conrad-Hengerer 2013 (1)	1	73	0	73	17.1%	7.39 [0.15 , 372.38]
Conrad-Hengerer 2014 (1)	0	104	1	104	17.1%	0.14 [0.00 , 6.82]
Conrad-Hengerer 2015 (1)	0	100	0	100		Not estimable
Kovacs 2014	0	40	0	39		Not estimable
Kránitz 2012	0	20	0	25		Not estimable
Mursch-Edlmayr 2017 (1)	0	50	0	50		Not estimable
Nagy 2011	0	54	0	57		Not estimable
Nagy 2014	0	20	0	20		Not estimable
Schargus 2015 (1)	1	37	3	37	65.7%	0.35 [0.05 , 2.61]
Zhang 2016	0	153	0	161		Not estimable
Subtotal (95% CI)		**698**		**713**	**100.0%**	**0.50 [0.10 , 2.55]**

Analysis 1.9. (Continued)

Zhang 2016	0	153	0	161		Not estimable
Subtotal (95% CI)		**698**		**713**	**100.0%**	**0.50 [0.10 , 2.55]**
Total events:	2		4			
Heterogeneity: Chi² = 2.36, df = 2 (P = 0.31); I² = 15%						
Test for overall effect: Z = 0.83 (P = 0.41)						
1.9.4 Posterior capsule opacification						
Day 2020	4	391	6	389	37.6%	0.66 [0.19 , 2.31]
Kovacs 2014	0	40	0	39		Not estimable
Liu 2021 (1)	5	78	4	78	32.5%	1.26 [0.33 , 4.84]
Oka 2021 (1)	1	55	1	55	7.5%	1.00 [0.06 , 16.19]
Roberts 2019	2	116	2	118	15.0%	1.02 [0.14 , 7.32]
Yu 2015	0	25	2	29	7.4%	0.15 [0.01 , 2.48]
Subtotal (95% CI)		**705**		**708**	**100.0%**	**0.81 [0.38 , 1.73]**
Total events:	12		15			
Heterogeneity: Chi² = 1.98, df = 4 (P = 0.74); I² = 0%						
Test for overall effect: Z = 0.55 (P = 0.58)						
Test for subgroup differences: Chi² = 0.00, df = 3 (P < 0.00001), I² = 0%						



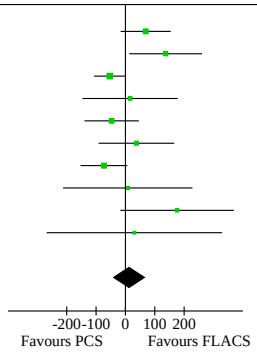
Footnotes

(1) Within-person (paired eye) study

Analysis 1.10. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 10: Endothelial cell loss

Study or Subgroup	FLACS Mean	FLACS SD	FLACS Total	PCS Mean	PCS SD	PCS Total	Weight	Mean Difference IV, Random, 95% CI	Risk of Bias A B C D E F
Chee 2021	-236	156	23	-305	201	48	14.2%	69.00 [-16.43 , 154.43]	+ ? − − + ?
Conrad-Hengerer 2013 (1)	-200	375.5	73	-337	388.2	73	10.0%	137.00 [13.10 , 260.90]	? ? − + + ?
Day 2020	-228	353	304	-175	312	284	18.4%	-53.00 [-106.77 , 0.77]	+ ? − + + +
Hansen 2020	-209	427	64	-225	534	71	7.1%	16.00 [-146.40 , 178.40]	? ? − − ? ?
Krarup 2021 (1)	-606	166	20	-559	131	20	13.3%	-47.00 [-139.68 , 45.68]	+ ? − + + ?
Mursch-Edlmayr 2017 (1)	-39.4	298.3	47	-76.8	338.6	47	9.5%	37.40 [-91.61 , 166.41]	+ ? − + ? ?
Roberts 2019	-301	320	116	-228	303	118	14.9%	-73.00 [-152.87 , 6.87]	+ ? − + + +
Schargus 2015 (1)	-69	505.9	37	-77	460.3	37	4.5%	8.00 [-212.39 , 228.39]	? + − − ? ?
Takacs 2012	-123	326.6	38	-299	513.2	38	5.5%	176.00 [-17.41 , 369.41]	+ ? − + ? ?
Yu 2015	-543.9	595.6	25	-574.5	512.8	29	2.7%	30.60 [-268.30 , 329.50]	? ? − ? ? ?
Total (95% CI)			**747**			**765**	**100.0%**	**12.24 [-39.99 , 64.47]**	

Heterogeneity: Tau² = 3116.38; Chi² = 18.41, df = 9 (P = 0.03); I² = 51%
Test for overall effect: Z = 0.46 (P = 0.65)
Test for subgroup differences: Not applicable



Footnotes

(1) Within-person (paired eye) study

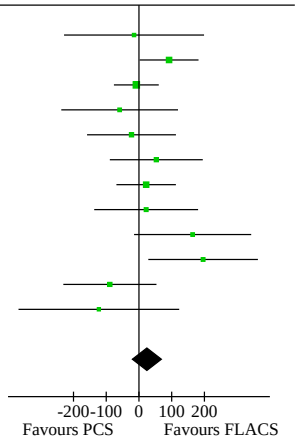
Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)

Analysis 1.11. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 11: Endothelial cell count final value

Study or Subgroup	FLACS Mean	FLACS SD	FLACS Total	PCS Mean	PCS SD	PCS Total	Weight	Mean Difference IV, Random, 95% CI
Chee 2021	2232	454	23	2247	376	48	3.8%	-15.00 [-228.87 , 198.87]
Conrad-Hengerer 2013 (1)	2207	264	73	2115	290	73	14.3%	92.00 [2.04 , 181.96]
Day 2020	2404	434	292	2412	406	286	19.0%	-8.00 [-76.50 , 60.50]
Dzhaber 2020 (1)	2374	527	67	2433	526	67	5.2%	-59.00 [-237.29 , 119.29]
Kanellopoulos 2016	2325.33	487.79	67	2348.12	286.63	66	8.1%	-22.79 [-158.53 , 112.95]
Liu 2021 (1)	2406	486	78	2353	416	78	7.6%	53.00 [-88.97 , 194.97]
Oka 2021 (1)	2583	215	53	2561	260	53	14.1%	22.00 [-68.83 , 112.83]
Schargus 2015 (1)	2758	370	37	2736	325	37	6.4%	22.00 [-136.68 , 180.68]
Schroeter 2021	2130	450.3	63	1966	567.7	63	5.2%	164.00 [-14.93 , 342.93]
Takacs 2012	2738	245	38	2542	466	38	5.8%	196.00 [28.61 , 363.39]
Vasvada 2019	2157.8	392.7	91	2246.6	570.3	91	7.6%	-88.80 [-231.07 , 53.47]
Yu 2015	2044.1	485.5	25	2166.6	426	29	3.0%	-122.50 [-367.97 , 122.97]
Total (95% CI)			**907**			**929**	**100.0%**	**24.18 [-20.06 , 68.43]**

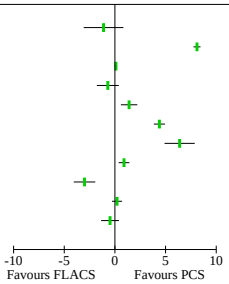
Heterogeneity: Tau² = 1465.57; Chi² = 14.80, df = 11 (P = 0.19); I² = 26%
Test for overall effect: Z = 1.07 (P = 0.28)
Test for subgroup differences: Not applicable



Footnotes
(1) Within-person (paired eye) study

Analysis 1.12. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 12: Total duration of procedure

Study or Subgroup	FLACS Mean [minutes]	FLACS SD [minutes]	FLACS Total	PCS Mean [minutes]	PCS SD [minutes]	PCS Total	Mean Difference IV, Random, 95% CI [minutes]	Risk of Bias A B C D E F
Chee 2021	15.26	3.51	23	16.38	4.72	48	-1.12 [-3.08 , 0.84]	+ ? − − + ?
Chen 2019	15.03	0.93	47	6.93	0.77	47	8.10 [7.75 , 8.45]	? ? − − ? ?
Conrad-Hengerer 2013 (1)	6.6	0.38	73	6.5	0.37	73	0.10 [-0.02 , 0.22]	? ? − + + ?
Day 2020	17.1	7.4	392	17.8	8	389	-0.70 [-1.78 , 0.38]	+ ? − + + +
Dzhaber 2020 (2)	8	2.8	67	6.6	1.9	67	1.40 [0.59 , 2.21]	+ ? − − + ?
Krarup 2021 (2)	14.9	1.2	31	10.51	1	31	4.39 [3.84 , 4.94]	+ ? − + + ?
Mursch-Edlmayr 2017 (2)	16.6	4.4	47	10.21	2.8	47	6.39 [4.90 , 7.88]	+ ? − + ? ?
Pajic 2017	7.5	1.22	68	6.6	1.76	62	0.90 [0.37 , 1.43]	? ? − − + ?
Roberts 2019	11.7	3.5	200	14.7	6.8	200	-3.00 [-4.06 , -1.94]	+ ? − + + +
Schargus 2015 (3)	6.25	1.36	37	6.04	0.72	37	0.21 [-0.29 , 0.71]	? + − − ? ?
Yu 2015	10.04	1.37	25	10.52	1.92	29	-0.48 [-1.36 , 0.40]	? ? − ? ? ?

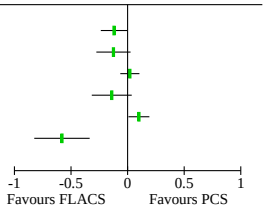


Footnotes
(1) "Mean surgical time", within-person (paired eye) study
(2) Within-person (paired eye) study
(3) "Total surgery time", within-person (paired eye) study

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)

Analysis 1.13. Comparison 1: Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery, Outcome 13: Refractive outcomes - mean absolute error

	FLACS			PCS			Mean Difference	Mean Difference
Study or Subgroup	Mean [dioptres]	SD [dioptres]	Total	Mean [dioptres]	SD [dioptres]	Total	IV, Random, 95% CI [dioptres]	IV, Random, 95% CI [dioptres]
Filkorn 2012	0.38	0.28	77	0.5	0.38	57	-0.12 [-0.24 , -0.00]	
Mastropasqua 2014b	0.435	0.2284	60	0.56	0.39	30	-0.13 [-0.28 , 0.03]	
Roberts 2019	0.42	0.4	200	0.4	0.46	200	0.02 [-0.06 , 0.10]	
Schroeter 2021	-0.2	0.49	63	-0.06	0.52	63	-0.14 [-0.32 , 0.04]	
Schweitzer 2020	0.5	1.1	659	0.4	0.5	653	0.10 [0.01 , 0.19]	
Yu 2015	0.16	0.16	25	0.74	0.65	29	-0.58 [-0.82 , -0.34]	



ADDITIONAL TABLES

Table 1. Sensitivity analysis excluding within-person (paired-eye) studies

Outcome (analysis)	Effect estimate	Analysis with all studies			Analysis excluding within-person studies		
		n	N	Effect estimate (95% CI)	n	N	Effect estimate (95% CI)
Anterior capsule tears (1.1)	OR	29	5835	0.83 (0.40 to 1.72)	25	4683	0.68 (0.31 to 1.51)
Posterior capsule tears (1.2)	OR	33	5767	0.50 (0.25 to 1.00)	32	4895	0.53 (0.26 to 1.06)
Corrected distance visual acuity 6 months or more (1.5)	MD	—	1323	-0.01 (-0.02 to -0.00)	—	987	-0.02 (-0.04 to -0.00)
Cystoid macular oedema (1.9.1)	OR	91	4441	0.84 (0.56 to 1.28)	74	3515	0.88 (0.55 to 1.40)
Endothelial cell loss (1.10)	MD	—	1512	12.24 (-39.99 to 64.47)	—	1158	2.67 (-65.74 to 71.09)

CI: confidence interval MD: mean difference OR: odds ratio
n = number of events; N = total number of eyes

APPENDICES

Appendix 1. CENTRAL search strategy

#1 MeSH descriptor: [Phacoemulsification] this term only
#2 pha?oemulsif*
#3 phaco or phako
#4 MeSH descriptor: [Capsulorhexis] this term only
#5 Capsulorhexis* or capsulotom*
#6 #1 or #2 or #3 or #4 or #5
#7 MeSH descriptor: [Lasers] explode all trees
#8 laser*
#9 femtosecond
#10 lensx or lensar or victus
#11 #7 or #8 or #9 or #10
#12 #6 and #11

Appendix 2. MEDLINE Ovid

1. randomized controlled trial.pt.
2. (randomized or randomised).ab,ti.
3. placebo.ab,ti.
4. dt.fs.
5. randomly.ab,ti.
6. trial.ab,ti.
7. (group or groups).ab,ti.
8. or/1-7
9. exp animals/
10. exp humans/
11. 9 not (9 and 10)
12. 8 not 11
13. phacoemulsification/
14. pha?oemulsif$.tw.
15. (phaco or phako).tw.
16. capsulorhexis/
17. (capsulor?hexis$ or capsulotom$).tw.
18. or/13-17
19. exp lasers/
20. laser$.tw.
21. femtosecond.tw.
22. (lensx or lensar or victus).tw.
23. or/19-22
24. 18 and 23
25. 12 and 24

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

Appendix 3. EMBASE Ovid

1. exp randomized controlled trial/
2. exp randomization/
3. exp double blind procedure/
4. exp single blind procedure/
5. random$.tw.
6. or/1-5
7. (animal or animal experiment).sh.
8. human.sh.
9. 7 and 8
10. 7 not 9
11. 6 not 10
12. exp clinical trial/
13. (clin$ adj3 trial$).tw.
14. ((singl$ or doubl$ or trebl$ or tripl$) adj3 (blind$ or mask$)).tw.

15. exp placebo/
16. placebo$.tw.
17. random$.tw.
18. exp experimental design/
19. exp crossover procedure/
20. exp control group/
21. exp latin square design/
22. or/12-21
23. 22 not 10
24. 23 not 11
25. exp comparative study/
26. exp evaluation/
27. exp prospective study/
28. (control$ or prospectiv$ or volunteer$).tw.
29. or/25-28
30. 29 not 10
31. 30 not (11 or 23)
32. 11 or 24 or 31
33. phacoemulsification/
34. pha?oemulsif$.tw.
35. (phaco or phako).tw.
36. capsulorhexis/
37. capsulotomy/
38. (capsulorhexis$ or capsulotom$).tw.
39. or/33-38
40. exp laser/
41. laser$.tw.
42. femtosecond.tw.
43. (lensx or lensar or victus).tw.
44. or/40-43
45. 32 and 39 and 44

Appendix 4. LILACS search strategy

phacoemulsif$ or phakoemulsif$ or phaco or phako or capsulorhexis or capsulorrhexis or capsulotom$ and laser$ or femtosecond or lensx or lensar or victus

Appendix 5. ISRCTN search strategy

(Phacoemulsification OR Phakoemulsification OR Phaco OR Phako OR or capsulorhexis OR capsulorrhexis OR capsulotomy) AND (Laser OR Femtosecond OR lensx OR lensar OR victus)

Appendix 6. ClinicalTrials.gov search strategy

(Phacoemulsification OR Phakoemulsification OR Phaco OR Phako OR capsulorhexis OR capsulorrhexis OR capsulotomy) AND (Laser OR Femtosecond OR lensx OR lensar OR victus)

Appendix 7. ICTRP search strategy

Phacoemulsification OR Phakoemulsification OR Phaco OR Phako OR capsulorhexis OR capsulorrhexis OR capsulotomy = Title AND Laser OR Femtosecond OR lensx OR lensar OR victus = Intervention

Appendix 8. FDA search strategy

phacoemulsification AND laser OR femtosecond OR lensx OR lensar OR victus AND random OR randomly OR randomised OR randomized

WHAT'S NEW

Date	Event	Description
23 June 2023	New citation required but conclusions have not changed	Search updated. New studies for inclusion.

Date	Event	Description
23 June 2023	New search has been performed	This review has been extensively updated. We included 13 new randomised controlled trials. Conclusions unchanged.

HISTORY

Protocol first published: Issue 9, 2013
Review first published: Issue 7, 2016

CONTRIBUTIONS OF AUTHORS

ACD and CB contributed to the concept, design and writing of the initial protocol. DMG contributed to the design and provided feedback for the protocol.

In this update, AN and ACD reviewed the titles and abstracts from the electronic literature searches and extracted data from these for the update. JE assisted with data analysis and write-up and CB assisted with statistical analysis. All authors contributed to the drafting of the manuscript.

DECLARATIONS OF INTEREST

Alex Day was the sub-Principal Investigator for the FACT trial (ISRCTN77602616). Catey Bunce is a Co-Applicant for the ongoing FACT trial (ISRCTN77602616).

Akshay Narayan, Daniel Gore, Jennifer Evans: none to declare.

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Internal sources

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External sources

- National Institute for Health Research (NIHR), UK

  Up to March 2021, this review update was supported by the National Institute for Health Research, via Cochrane Infrastructure funding to the Cochrane Eyes and Vision (CEV) UK editorial base
- Public Health Agency, UK

  As of April 2021, the HSC Research and Development (R&D) Division of the Public Health Agency funds the CEV editorial base at Queen's University Belfast

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

The differences between the protocol (Day 2013) and the review are summarised below.

For review version published 2016

We changed the title to "Laser-assisted cataract surgery versus standard ultrasound phacoemulsification cataract surgery". The title was previously "Laser assisted versus manual phacoemulsification for lens extraction."

We modified the outcomes to include outcomes of relevance to the proposed National Institute for Health and Care Excellence (NICE) Cataract Surgery Guidelines. In particular we included refractive outcomes (including deviation from the predicted refractive outcome), we included patient-reported outcomes such as satisfaction, and included resources used, such as total duration of procedure, in addition to costs.

Summary of findings tables and GRADE assessment were not specified in the original protocol and have since been added in following changes in Cochrane methods over the time period.

Some planned methods could not be performed because there were too few trials supplying relevant data. We therefore did not do any subgroup analysis according to type of laser system used and we did not do a sensitivity analysis excluding trials at high risk of bias.

For the review version published 2023

We added endothelial cell count data to the outcomes.

In response to peer review comments, for the outcomes both meta-analysed and included in the summary of findings table, we conducted a sensitivity analysis excluding within-person (paired-eye) studies.

INDEX TERMS

Medical Subject Headings (MeSH)

*Cataract [complications]; *Cataract Extraction [adverse effects]; Lasers; *Macular Edema [etiology]; *Phacoemulsification [adverse effects] [methods]

MeSH check words

Humans