

Original Article

Efficacy comparison between manual small incision cataract surgery and phacoemulsification in cataract patients: a meta-analysis

Zi Ye, Shou-Zhi He, Zhao-Hui Li

Department of Ophthalmology, The PLA General Hospital, No. 28, Fuxing Road, Beijing 100853, China

Received February 11, 2015; Accepted May 25, 2015; Epub June 15, 2015; Published June 30, 2015

Abstract: Objective: Systematic review of manual small incision cataract surgery (MSICS) and phacoemulsification (PHACO) on the postoperative visual quality and surgical complications. Methods: Relevant literatures on clinical efficacy of PHACO and MSICS were included by retrieving in Medline, PubMed, Chinese Biomedical Literature Database (CBM) and Chinese Academic Journal (CNKI) databases. Meta-analysis was conducted by RevMan5.0 software with OR and its 95% CI for the effect size. Results: A total of ten documents were included in the study. Uncorrected visual acuity 1 week after surgery (OR = 0.84, 95% CI: 0.67 ~ 1.06, P=0.15), post-operative capsular rupture (OR = 1.07, 95% CI: 0.73~1.58, P=0.72), and corneal edema (OR = 0.90, 95% CI: 0.70~1.16, P=0.42) between MSICS and PHACO showed no statistical difference (P > 0.05). Conclusion: Clinical efficacy and complications of MSICS was similar to that of PHACO.

Keywords: Manual small incision cataract surgery, phacoemulsification, meta-analysis

Introduction

Cataract is the primary cause of blindness worldwide, while age-related cataract is the most common [1]. China is a populous country, and more than half of the 500 million blind people were caused by cataracts [2]. With the growing population of aging process, this data is constantly increasing. Surgery is the only effective method for treatment of cataracts [3]. Manual small incision cataract surgery and phacoemulsification were the common surgical method [4]. Evolving technologies make phacoemulsification become the mainstream for the treatment of cataract. However, some scholars believe that MSICS has the similar efficacy with PHACO, and the former is more convenient and economical [5-7]. In this study, Meta-analysis was carried out based on existing literatures for systematic, quantitative, comprehensive and integrated assessment in order to find a more safe and effective surgical method for more patients to relieve from pain.

Method

Search strategy

Medline, PubMed, Chinese Biomedical Literature Database (CBM) and Chinese Academic Journal (CNKI) were included in computer searching databases. Check the cataract journals and monographs manually, and consult the specialists on cataract. Search terms were the follows: non-phacoemulsification manual small incision cataract surgery, manual small incision cataract surgery, PHACO, phacoemulsification, and cataract.

Inclusion criteria

The included studies must meet to the following criteria: 1) the prospective randomized study; 2) clinical trials; 3) research on MSICS and PHACO contrast; 4) diagnosed as age-related cataract, cornea and no serious lesions, vitreous, retina, etc; 5) Age, gender and the hardness of lens nucleus should be comparable in

Comparison between MSICS and PHACO

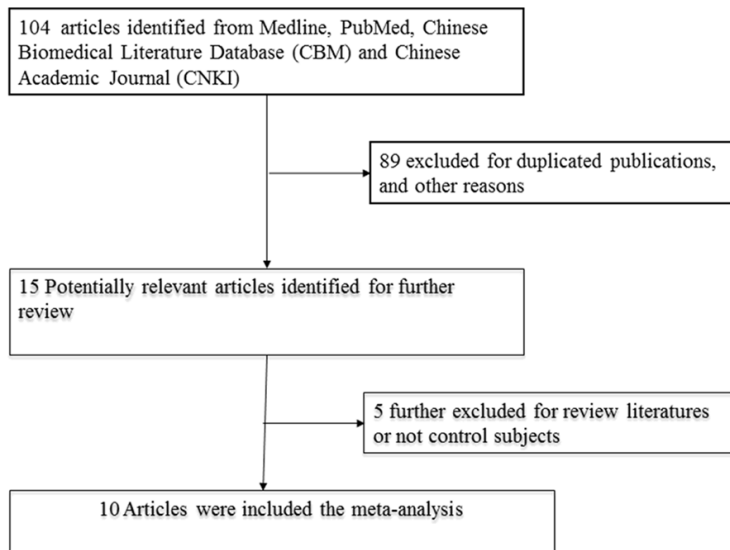


Figure 1. The flow chart of studies identification.

the two groups; 6) record visual acuity and postoperative complications.

Exclusion criteria

We excluded the literatures if 1) retrospective clinical studies, non-randomized controlled studies and observational studies; 2) congenital cataract, traumatic cataract and metabolic cataracts; 3) severe cornea, vitreous and retinal lesions; 4) duplicate publication and documents with incomplete information; 5) other trials and studies outside the clinic.

Quality assessment criteria

Jadad quality scoring method [8] was used for quality assessment of the included studies.

Data extraction

Data were extracted by two independent reviewers; the extracted contents were discussed and decided by two reviewers before excerpting; in order to avoid subjective bias, the author's name, the journal name, year and country were omitted when extracting the data. Extracted contents included the basic information, case characteristics and each outcome and measured data in the randomized controlled trials.

Statistical methods

RevMan 5.0 software was used for Meta-analysis. Count data used RR or OR as the

effect size, with each effect size and 95% CI to represent the results. Firstly clinical heterogeneity of the included studies was tested (Q test), if there was no heterogeneity among studies ($P > 0.1$, $I^2 < 50\%$), a fixed effects model was selected for Meta-analysis; If there was heterogeneity among studies ($P < 0.1$, $I^2 > 50\%$), the reasons for heterogeneity were analyzed, and subgroup analysis of factors that could cause heterogeneity was conducted; if there was significant heterogeneity between two study groups but with no clinical heterogeneity or no statistically significant difference, a random effects model should be selected; if the heterogeneity was too large between two groups or data sources were unavailable, descriptive analysis was used.

Results

General information and quality evaluation of the included literature

As shown in **Figure 1**, through literature search and based on inclusion and exclusion criteria, ten relevant literatures were obtained. The characteristics of the included studies were shown in **Table 1**.

Meta-analyses

Uncorrected visual acuity in 1 week after surgery

A total of six documents were included. No heterogeneity had been found among studies [9-14], therefore, a fixed effects model was used. The results showed, there was no significant difference between MSICS and PHACO in improving one-week-postoperative uncorrected visual acuity ($Z = 1.45$, $P = 0.15$; OR = 0.84, 95% CI: 0.67~1.06), shown in **Figure 2**.

Posterior capsular rupture

A total of five documents were included. The lens posterior capsule rupture was compared in surgery and no heterogeneity had been found among studies [11-13, 15, 16], therefore

Comparison between MSICS and PHACO

Table 1. The characteristics of included studies

| First authors | Country | Publication Year | Number of case (MSICS/PHACO) | Follow up time (Week) | Lost of follow up | Jadad Scores |
|-----------------|---------|------------------|------------------------------|-----------------------|-------------------|--------------|
| Gogate et al. | India | 2005 | 200/200 | 6 | 0 | 2 |
| George et al. | India | 2005 | 53/63 | 6 | 0 | 1 |
| Lin RJ et al. | China | 2007 | 747/806 | 1 | 0 | 1 |
| Zhang L et al. | China | 2006 | 70/70 | 1 | 0 | 1 |
| Xu QL et al | China | 2007 | 52/56 | 12 | 0 | 2 |
| Ji Z et al. | China | 2011 | 180/180 | 1 | 0 | 1 |
| Zhang SH et al. | China | 2011 | 82/70 | 1 | 0 | 2 |
| Fu JM et al. | China | 2012 | 30/30 | 4 | 0 | 2 |
| Wang YJ et al. | China | 2012 | 370/330 | 4 | 0 | 2 |
| Khanna et al. | China | 2014 | 522/507 | 12 | 0 | 2 |

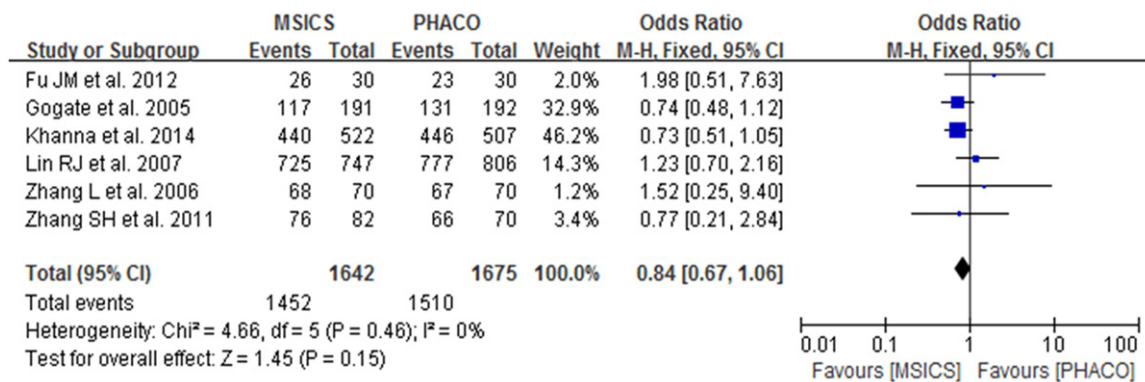


Figure 2. Forest plot of uncorrected visual acuity in 1 week after surgery between MSICS and PHACO. The horizontal lines correspond to the study-specific OR and 95% CI, respectively. The area of the squares reflects the study-specific weight. The diamond represents the pooled results of OR and 95% CI.

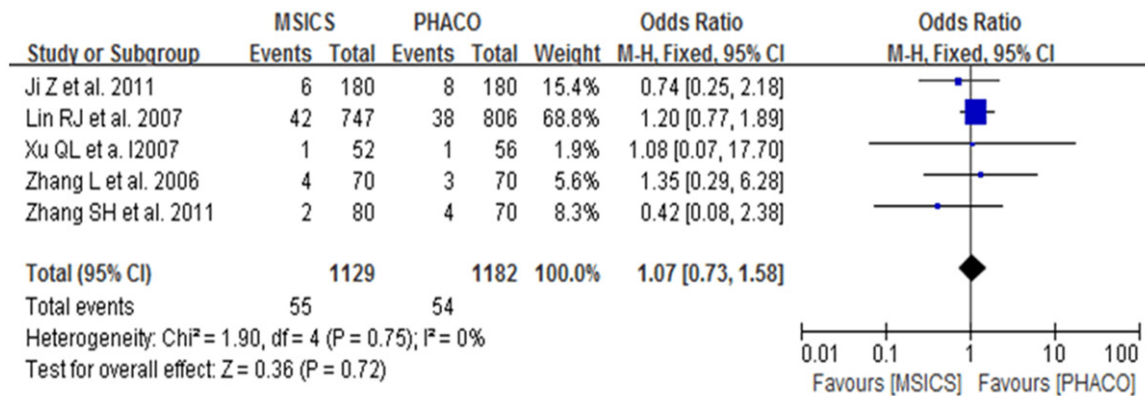


Figure 3. Forest plot of posterior capsular rupture after surgery between MSICS and PHACO. The horizontal lines correspond to the study-specific OR and 95% CI, respectively. The area of the squares reflects the study-specific weight. The diamond represents the pooled results of OR and 95% CI.

a fixed effects model was used. The results showed, there was no significant difference between MSICS and PHACO in posterior capsule rupture (Z = 0.36, P = 0.72; OR = 1.07, 95% CI, 0.73~1.58), shown in **Figure 3**.

Corneal edema on first day after surgery

A total of six documents were included. The corneal edema on postoperative day 1 was compared and no heterogeneity had been found

Comparison between MSICS and PHACO

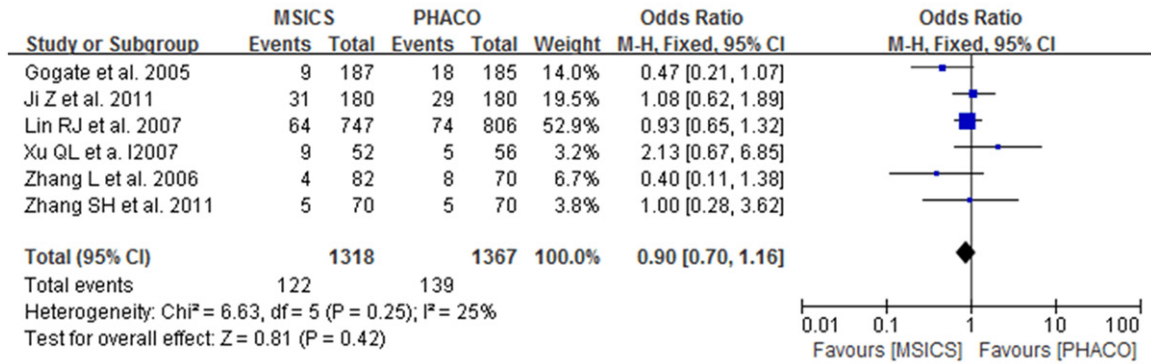


Figure 4. Forest plot of corneal edema on first day after surgery between MSICS and PHACO. The horizontal lines correspond to the study-specific OR and 95% CI, respectively. The area of the squares reflects the study-specific weight. The diamond represents the pooled results of OR and 95% CI.

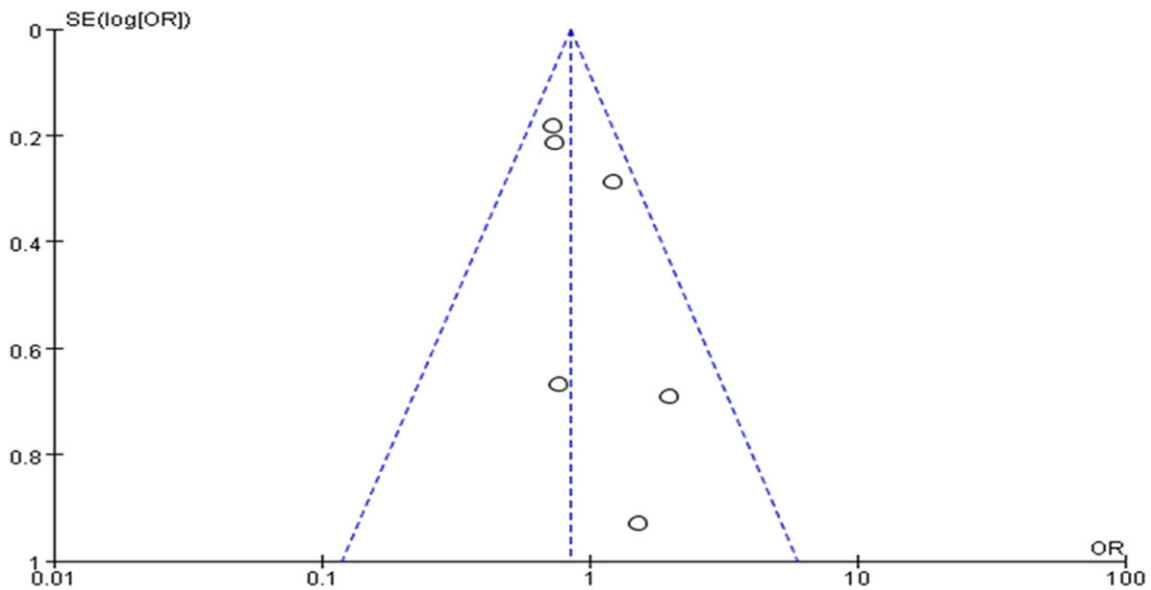


Figure 5. Funnel plot for publication bias test. Each circle denotes an independent study for the indicated association. $\text{Log} [OR]$, natural logarithm of OR. Horizontal line stands for mean effect size.

among studies [9-13, 15], therefore, a fixed effects model was used. The results showed, there was no significant difference between MSICS and PHACO in corneal edema on post-operative day 1 ($Z = 0.81$, $P=0.42$; $OR = 0.90$, 95% CI 0.70~1.16), shown in **Figure 4**.

Publication bias analysis

We analyzed publication bias using Revman 5.0 software. As shown in **Figure 5**, the points distribution was even and symmetry. All of the points were within the 95% confidence interval. The results indicated there is no publication bias, and the result of study is credible.

Sensitivity analysis

In this study, various outcome measures were further analyzed after excluding low-quality studies and recombining the results of the remaining studies. Comparisons of the meta-analysis results before and after this exclusion revealed no significant differences, indicating that the analysis exhibited relatively low sensitivity and that therefore the analysis results were relatively robust and credible.

Discussion

With the continuous improvement of the operating skills of phacoemulsification and the

Comparison between MSICS and PHACO

development of ultrasound emulsification equipment, PHACO has become a mainstream treatment of cataract; on the contrary, MSICS was used less and less. However, some academics have suggested that MSICS and PHACO have the same clinical effect, even in elderly cataract patients MSICS postoperative complications are less than PHACO complications; MSICS and PHACO have similar clinical efficacy, but MSICS cost less [17, 18]. MSICS has the same eyebrow-shaped tunnel incision with PHACO, so that both ends are far from the limbus and a good suspension is formed, effectively preventing the sagging of upper lip and maintaining the incision not split, then ensuring good closure of the incision; Incision flap was self-closing under eye pressure so that the anterior chamber did not collapse when operating. This allowed MSICS to equally have quick recovery of visual acuity and little astigmatism, avoiding the corneal endothelium and other eye tissue damage caused by the blind pursuit of phacoemulsification, and the prolonged phaco time and increased energy in hard-core cataract particularly.

To further clarify the difference between MSICS and PHACO for improving visual acuity and complications, we conducted this Meta-analysis. The results of the study showed, there was no statistically significant difference in 1 week-postoperative uncorrected visual acuity, posterior capsular rupture, and corneal edema between MSICS and PHACO. As can be seen from the results of this study, MSICS had similar clinical effects with PHACO in the treatment of age-related cataract. Previous study reported that the surgery rate of cataract patients with surgical indications was only 8.14% [19]; the personal affordability, social economic, the number of the surgeon and skill limitation were the main factors affecting the rate of surgery [19]. PHACO and MSICS have similar efficacy, but compared with the latter, the former has the advantages of simple operation, short learning curve, low equipment requirement, low operation cost and less cost, which is easier to be mastered by young doctors and spread in primary hospitals, and more in line with China's national conditions.

In this study, the small sample size may have a certain impact on the results of the analysis, so we need to increase the sample size and

include more randomized control study with high quality to improve the credibility of the conclusions.

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Zhao-Hui Li, Department of Ophthalmology, The PLA General Hospital, No. 28, Fuxing Road, Beijing 100853, China. Tel: +8613701239057; Fax: +86137012-39057; E-mail: lizhaohui1965@126.com

References

- [1] Oliva MS, Schottman T, Gulati M. Turning the tide of corneal blindness. *Indian J Ophthalmol* 2012; 60: 423-7.
- [2] Lin H, Yang Y, Chen J, Zhong X, Liu Z, Lin Z, Chen W, Luo L, Qu B, Zhang X, Zheng D, Zhan J, Wu H, Wang Z, Geng Y, Xiang W, Chen W, Liu Y; CCPMOH Study Group. Congenital cataract: prevalence and surgery age at Zhongshan Ophthalmic Center (ZOC). *PLoS One* 2014; 9: e101781.
- [3] Mohamed A, Gilliland KO, Metlapally S, Johnsen S, Costello MJ. Simple fixation and storage protocol for preserving the internal structure of intact human donor lenses and extracted human nuclear cataract specimens. *Mol Vis* 2013; 19: 2352-9.
- [4] Jongsareejit A, Wiriyaluppa C, Kongsap P, Phumiphan S. Cost-effectiveness analysis of manual small incision cataract surgery (MSICS) and phacoemulsification (PE). *J Med Assoc Thai* 2012; 95: 212-20.
- [5] Briesen S, Roberts H, Lewallen S. The importance of biometry to cataract outcomes in a surgical unit in Africa. *Ophthalmic Epidemiol* 2010; 17: 196-202.
- [6] Das S, Khanna R, Mohiuddin SM, Ramamurthy B. Surgical and visual outcomes for posterior polar cataract. *Br J Ophthalmol* 2008; 92: 1476-8.
- [7] Tabin G, Chen M, Espandar L. Cataract surgery for the developing world. *Curr Opin Ophthalmol* 2008; 19: 55-9.
- [8] McCormick F, Cvetanovich GL, Kim JM, Harris JD, Gupta AK, Abrams GD, Romeo AA, Provencher MT. An assessment of the quality of rotator cuff randomized controlled trials: utilizing the Jadad score and CONSORT criteria. *J Shoulder Elbow Surg* 2013; 22: 1180-5.
- [9] Gogate PM, Kulkarni SR, Krishnaiah S, Deshpande RD, Joshi SA, Palimkar A, Deshpande MD. Safety and efficacy of phacoemulsification compared with manual small-incision cataract

Comparison between MSICS and PHACO

- surgery by a randomized controlled clinical trial: six-week results. *Ophthalmology* 2005; 112: 869-74.
- [10] Khanna RC, Kaza S, Palamaner Subash Shantha G, Sangwan VS. Comparative outcomes of manual small incision cataract surgery and phacoemulsification performed by ophthalmology trainees in a tertiary eye care hospital in India: a retrospective cohort design. *BMJ Open* 2012; 2: e001035.
- [11] Lin RJ, Li LJ. Study on Small incision sutureless cataract extraction and intraocular lens implantation surgery. *Zhong Guo Yi Shi Jin Xiu Za Zhi* 2007; 30: 21-23.
- [12] Zhang L, Liu L. Small incision sutureless cataract surgery. *Yan Wai Shang Zhi Ye Bing Za Zhi* 2006; 28: 346-348.
- [13] Zhang SH, Liao RB, Cai SH. The clinical efficacy of nuclear techniques broken small incision cataract surgery. *Guang Dong Yi Xue* 2011; 32: 2305-2307.
- [14] Fu JM, Ying TR, Zheng HH. Clinical Study of senile cataract surgical treatment. *Zhong Guo Xian Dai Yi Sheng* 2012; 5036-38.
- [15] Ji Z. Efficacy comparison between small incision ECCE and phacoemulsification surgery in cataract patients. *Zhong Guo Yi Shi Jin Xiu Za Zhi* 2011; 34: 26-28.
- [16] Wang YJ. Observe small incision phacoemulsification cataract senile effect. *He Bei Yi Xue* 2012; 18: 1214-1216.
- [17] Zhang LQ. Small incision cataract surgery in elderly patients. *Zhong Guo Yi Yao Zhi Nan* 2012; 10: 532-533.
- [18] George R, Rupauliha P, Sripriya AV, Rajesh PS, Vahan PV, Praveen S. Comparison of endothelial cell loss and surgically induced astigmatism following conventional extracapsular cataract surgery, manual small-incision surgery and phacoemulsification. *Ophthalmic Epidemiol* 2005; 12: 293-7.
- [19] He W, Xue L, Zhang X. Nonphacoemulsification small incision extracapsular cataract surgery in China. *Zhong Guo Shi Yong Yan Ke Za Zhi* 2005; 23: 121-123.