ORIGINAL ARTICLE

A Comparative Study of Planned and Unplanned Manual Small Incision Cataract Surgery (MSICS) Outcomes at Nan Hospital, Thailand: A Retrospective Study

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Objective: To compare the visual outcomes and complications of planned and unplanned manual small incision cataract surgery (MSICS) using Ruit technique in cataract patients.

Materials and Methods: The medical records of 3,107 eyes for 2,642 patients with cataracts who underwent MSICS using the Ruit technique at Nan Hospital between January 2016 and April 2023 were retrospectively reviewed. MSICS used a temporal scleral tunnel incision. All 3,107 surgeries were performed by a single surgeon. Out of these 908 eyes of 719 patients, 411 eyes missed the six-week follow-up, the data were incomplete on 195 eyes, 58 eyes underwent combined ocular procedures, and 244 eyes had preoperative vision impairing pathology or previous ocular surgeries. Medical records of 2,199 eyes from 1,923 patients were analyzed, including data on preoperative and postoperative uncorrected visual acuity (UCVA), operative time, intra- and postoperative complications, and astigmatism at the second and sixth weeks after surgery.

Results: MSICS using Ruit technique was performed on 2,199 eyes of 1,923 patients. Both groups achieved excellent surgical outcomes with low complication. The postoperative UCVA at the sixth-week follow-up was 20/70 or better in 96.2% (1,467 out of 1,526 patients) in the planned group and 94.7% (637 out of 673 patients) in the unplanned group. At the sixth week after treatment, the median postoperative astigmatism of both groups were –1.0 (IQR –1.5 to –0.5) D. Hyphema was the most frequent intraoperative complication found in both groups, equating to 5.9% (90 out of 1,526 patients) in the planned group and 8.2% (55 out of 673 patients) in the unplanned group. There was no significant difference in the visual results and complication rates between the groups ($p<0.05$).

Conclusion: The present study demonstrates that cataract surgery in the unplanned group was safe, and the outcomes in terms of visual results and complications were comparable to those of the planned group. The findings revealed that favorable visual outcomes could be achieved with Ruit technique MSICS.

Keywords: Ruit technique; Manual small incision cataract surgery

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Cataracts are the main cause of blindness worldwide, at 52.6%[1], including Thailand at 51.9%[2]. Phacoemulsification is the preferred technique for cataract surgery in developed countries. The manual small incision cataract surgery (MSICS) is a safe technique for cataract extraction, providing excellent visual outcomes with low complication rates. It also requires a short operation time, can be performed on all cataract stages[3], is less technology dependent, and cost effective[4-6]. In 1999, Ruit et al. described a new technique for MSICS[4]. More than 85% of postoperative patients using Ruit technique for MSICS presented visual acuity better than or equal to 20/60, the quality target recommended by the World Health Organization (WHO)[4,7,8]. Cataract surgical coverage is inadequate in many places, even when services are available due to the barriers preventing patient access. Modifying service activity to reduce these barriers is critical for increasing cataract surgical coverage.

Retrieved data of these patients were analyzed including demographics such as age, gender, preoperative and postoperative uncorrected visual acuity (UCVA), operative time, intraoperative complications, postoperative complications, and postoperative astigmatism at the second and sixth weeks after surgery.

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Materials and Methods

The present study was a retrospective study. The medical records of all patients diagnosed with cataracts at Nan Hospital, Nan Province, Thailand, between January 1, 2016 and April 20, 2023, who underwent MSICS using Ruit technique with the implantation of an intraocular lens (IOL) were reviewed. Patients were classified into two groups according to the surgery scheduling. The planned group consisted of patients scheduled for cataract surgery, while the unplanned group consisted of those not scheduled, or walk-in, for cataract surgery. Patients with a history of ocular surgery or any other preoperative ocular pathology that could reduce vision such as cataract trauma, lens subluxation, age-related macular degeneration, other retinal conditions, severe glaucoma, optic atrophy, corneal scarring, large pterygium, and amblyopia, or those who undergone combined ocular procedures were excluded from the study. Similarly, those patients who failed to attend the six-week follow-up were excluded from the study. The present study was approved by the Research Ethics Committee (COA No. 078 Nan Hos. REC 078/2023).

Surgical technique

The patient had a retrobulbar block in the operating room. After dilating the pupil pre-operatively, a temporal limbal conjunctival peritomy was performed with diathermy to achieve hemostasis. A temporal scleral tunnel 7 to 9 mm in width, depending on the size of the nucleus, with a straight incision was being created with a 2.0 mm beveled-up crescent blade, starting from 1.5 to 2mm posterior to the limbus, and advanced anteriorly along the plane of sclera and mid-posterior corneal stroma until approximately 1 to 1.5 mm beyond the limbus without entering the anterior chamber. The scleral tunnel wound was being further enlarged internally within the cornea so that the inner wound was larger than the outer wound. A paracentesis was done to facilitate intraocular manipulation at 90° from the scleral tunnel using a 22-gauze needle. A viscoelastic substance was injected through a paracentesis to protect the corneal endothelium and v-capsulotomy or u-capsulotomy, then performed through the scleral tunnel wound by using a 25-gauze needle. The anterior chamber was entered, and the tunnel extended with a keratome of 3.0 mm. The nucleus was subluxated into the anterior chamber and out through the scleral tunnel wound, with gentle depression on the posterior scleral tunnel wound edge by using a 21-gauze irrigation-aspiration Ruit simcoe cannula. The epinucleus and cortical cortex were removed using Simcoe cannula. A 6 mm single-piece polymethylmethacrylate (PMMA) IOL was inserted into the capsular bag under a viscoelastic substance and proper positioning was done by dialer. The base of the anterior capsule flap was transected with capsule scissors, and the flap was removed using fragment forceps. Aspiration of viscoelastic material was done. A watertight wound was checked for the absence of leak and if present, the wound was sutured with one stitch with nylon 10/0. After checking, an anterior chamber was formed with an air bubble. The conjunctiva was cauterized, as shown in Figure 1.

Data analyses were performed using the IBM SPSS Statistics for Windows, version 21.0 (IBM Corp., Armonk, NY, USA). The numbers and percentages were described in a frequency table, with the descriptive statistics as range, mean, and standard deviation (SD) and p-values for differences in the two comparative groups' continuous variables calculated using the Mann-Whitney U (two-tailed) test whichever applicable. A p-value of less than 0.05 was considered to be statistically significant.

Results

Three thousand one hundred seven eyes for 2,642 patients underwent MSICS using the Ruit technique were included in the present study. A considerable number of patients were excluded from the study. Fifty-eight eyes underwent combined ocular procedures, and 244 eyes had preoperative vision impairing pathology or previous ocular surgeries. The data on 195 eyes were incomplete. Out of 908 eyes from 719 patients, 411 eyes missed the six-week follow-up. Of the remaining 2,199 eyes from 1,923 patients eligible for inclusion, 1,526 eyes had planned surgery and 673 eyes were unplanned. The demographic data and details of the preoperative findings for both groups are summarized in Table 1. Ruit technique MSICS was performed on all participants under local, retrobulbar, anesthesia involving a straight incision of the temporal scleral with the implantation of a rigid PMMA IOL having optical diameter 6.0 mm and A constant of 118.3. The 2,199 procedures were performed by a single surgeon. The IOL power was determined based on the immersion A-scan ultrasonography and automatic keratometry readings using the SRK II formula. The author aimed for a small degree of myopia, ranging from –0.25 D to –0.50 D, to offset possible biometric errors. Table 2 provides details of the surgical time, intraoperative complications, and postoperative

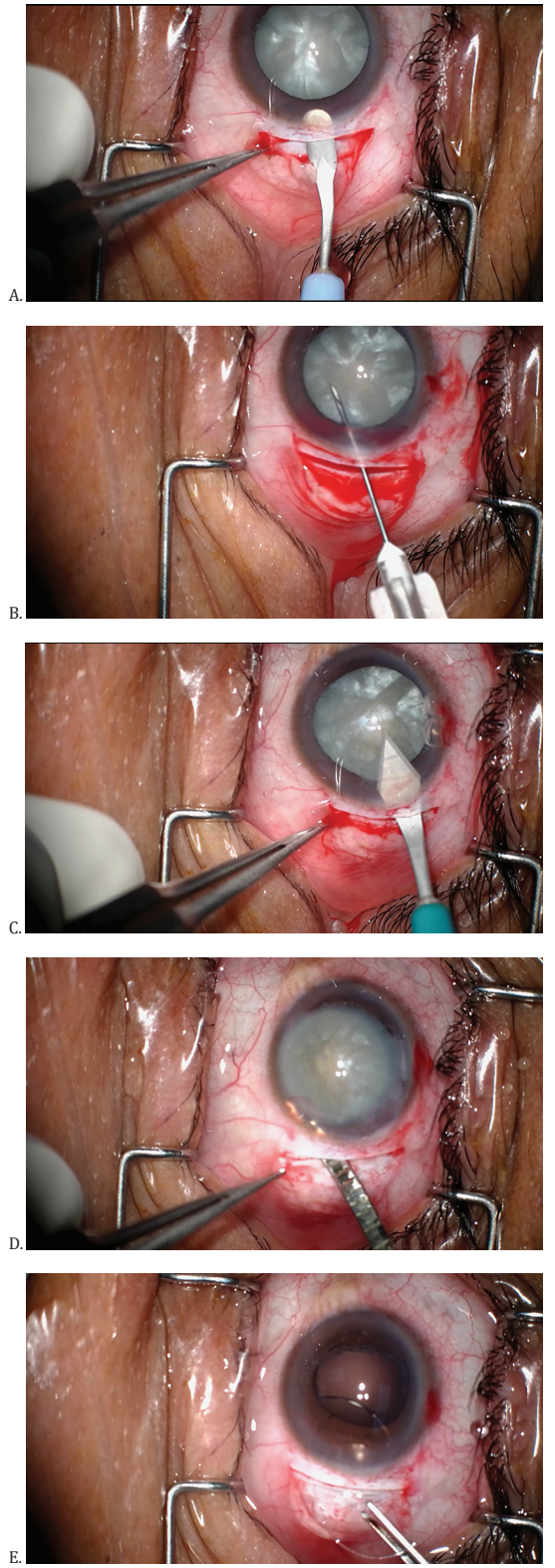

Figure 1. (A) Scleral tunnel construction, (B) V-capsulotomy, (C) Anterior chamber penetration, (D) Removal of lens nucleus with Ruit simcoe canula, (E) Insertion of IOL.

Table 1. Demographic characteristics of the study population

Characteristics	Planned	Unplanned
Total (eyes)	1,526	673
Age (years)		
Min-max	32 to 100	35 to 109
Mean±SD	69 ±9.4	70±10.5
Sex		
Male	688	299
Female	838	374
Preoperative UCVA; n (%)		
20/70 to 10/100	277 (18.2)	71 (10.5)
<10/200 to PL	1,249 (81.8)	602 (89.5)

SD=standard deviation; UCVA=uncorrected visual acuity; PL=perception of light

complications of the enrolled patients. Patients were examined on the first postoperative day, then followed up at two weeks, and finally at six weeks (Table 3).

The median surgical times of the planned and unplanned groups were 13 (IQR 11 to 16) minutes and 14 (IQR 11 to 17) minutes, respectively. Hyphema was found to be the most common intraoperative complication in both groups, with the planned group at 5.9% (90 out of 1,526 patients) and the unplanned group at 8.2% (55 out of 673 patients), followed by a posterior capsular tear without vitreous loss occurring during the surgery of 3.3% (51 out of 1,526 patients) for the planned group and 1.9% (13 out of 673 patients) for the unplanned group. The incidence of posterior capsular tear with vitreous loss in the planned and unplanned groups was 0.9% (13 out of 1,526 patients) and 0.4% (three out of 673 patients), respectively.

There were minor immediate postoperative complications. On the first postoperative day, 9% (138 out of 1,526 patients) and 8.5% (57 out of 673 patients) in the planned and unplanned groups had postoperative hyphema, respectively. Corneal edema in the planned group and unplanned groups was exhibited by 9% (138 out of 1,526 patients) and 10% (67 out of 673 patients), respectively (Table 2). Five eyes with mild corneal edema were determined at six weeks postoperatively, four eyes (0.3%) in the planned group and one eye (0.1%) in the unplanned group. Endophthalmitis was the most severe complication in the present study, occurring in 0.05% (one out of 2,119 patients). Surgical times and complications, along with postoperative complications are summarized in Table 2.

Both planned and unplanned patients achieved good visual results after MSICS. At two weeks,

Table 2. Surgical times, intraoperative, and postoperative complications

	Planned	Unplanned	p-value
Total (eyes)	1,526	673	
Surgical time (minutes); n (%)			0.25
<10 minutes	146 (9.6)	67 (10.0)	
10 to15 minutes	930 (60.9)	381 (56.6)	
>15 to 20 minutes	320 (21.0)	147 (21.8)	
>20 minutes	130 (8.5)	78 (11.6)	
Min-max	6 to 60	5 to 55	
Median (IQR)	13 (11 to 16)	14 (11 to 17)	
Intraoperative complications; n (%)			0.6
Hyphema	90 (5.9)	55 (8.2)	
Posterior capsule rupture without vitreous loss	51 (3.3)	13 (1.9)	
Posterior capsule rupture with vitreous loss	13 (0.9)	3 (0.4)	
Zonular dialysis without vitreous loss	3 (0.2)	1 (0.1)	
Zonular dialysis with vitreous loss	2 (0.1)	0 (0.0)	
Iris prolapse	4 (0.3)	6 (0.9)	
Incomplete cortex clean-up	5 (0.3)	0 (0.0)	
Postoperative complications first day; n (%)			0.95
Hyphema	138 (9.0)	57 (8.5)	
Corneal edema	138 (9.0)	67 (10.0)	
Postoperative complications sixth week; n (%)			0.86
Corneal edema	4 (0.3)	1 (0.1)	
Posterior capsule opacity	2 (0.1)	2 (0.3)	
Postoperative endophthalmitis; n (%)	1 (0.05)	0 (0.0)	

IQR=interquartile range

95.2% (1,453 out of 1,526 patients) and 92.6% (623 out of 673 patients) in the planned and unplanned groups, achieved UCVA of 20/70 or better and improved to 96.1% (1,467 out of 1,526 patients) and 94.7% (637 out of 673 patients) at the six-week follow-up, respectively (Table 3).

At the two-week follow-up, the median postoperative astigmatism in the planned group was –1.0 (IQR –1.5 to –0.8) D and –1.0 (IQR –1.8 to –0.5) D in the unplanned group. At the six-week follow-up, the median keratometric astigmatism of both groups were –1.0 (IQR –1.5 to –0.5) D (Table 3).

Discussion

The procedures under the present study comprised of phacoemulsification and MSICS. Although both phacoemulsification and MSICS provide excellent visual outcomes with low complication rates, the cost of MSICS is lower. The Ruit technique used in MSICS is a high-quality procedure that achieves excellent clinical outcomes with a low rate of complications for patients with cataracts in developing countries. The present study demonstrated the favorable outcomes achieved with this technique.

The majority of the patients receiving surgeries were from rural backgrounds. There are barriers preventing a patient from obtaining cataract surgery. These include the need for service delivery, affordability, no accompanying person, distance from the hospital, and lack of transportation. Eye services can be readily available and provide excellent outcomes. In developing countries with low-income populations, a growing backlog of blindness due to cataracts has resulted from insufficient healthcare access and resources. Effective programs are therefore required to reduce this backlog, such as increasing the number of cataract surgeries performed.

Most previous studies had reported visual outcomes in terms of BCVA, whereas the present study reported in terms of UCVA. A good surgical outcome after cataract surgery, according to the WHO, is a UCVA better than or equal to 20/70 Snellen. Vettorazzi et al. reported that 96.4% of patients had good outcomes as defined by the WHO[9]. These results were similar to those reported by Waghmare et al. at 98%[10], Gogate et al. at 98.36%[11], Ruit at 98%[8], Venkatesh et al. at 98.2%[6], and Rathi et al. at 100%[12]. The results for visual outcomes

Table 3. Postoperative outcomes in the second and sixth week

Outcomes	Planned	Unplanned	p-value
Total (eyes)	1,526	673	
Postoperative UCVA at two weeks; n (%)			0.032
20/20 to 20/40	1,185 (77.7)	497 (73.8)	
20/50 to 20/70	268 (17.6)	126 (18.7)	
<20/70 to 20/100	54 (3.5)	32 (4.8)	
<20/100 to 20/200	16 (0.1)	17 (2.5)	
<20/200 to 10/200	1 (0.1)	0 (0.0)	
<10/200 to PL	2 (0.1)	1 (0.1)	
Postoperative UCVA at six weeks; n (%)			0.42
20/20 to 20/40	1,240 (81.3)	539 (80.1)	
20/50 to 20/70	227 (14.9)	98 (14.6)	
<20/70 to 20/100	53 (3.5)	20 (3.0)	
<20/100 to 20/200	5 (0.3)	15 (2.2)	
<20/200 to 10/200	1 (0.1)	1 (0.1)	
Postoperative astigmatism at two weeks (diopter); n (%)			0.28
< –1.0 D	933 (61.1)	505 (75.0)	
–1.0 to –2.0 D	467 (30.6)	121 (18.0)	
< –2.0 D	126 (8.3)	47 (7.0)	
Median (IQR)	–1 (–1.5 to –0.8)	–1 (–1.8 to –0.5)	
Postoperative astigmatism at six weeks (diopter); n (%)			0.52
< –1.0 D	954 (62.5)	512 (76.1)	
–1.0 to –2.0 D	460 (30.1)	116 (17.2)	
< –2.0 D	112 (7.3)	45 (6.7)	
Median (IQR)	–1 (–1.5 to –0.5)	–1 (–1.5 to –0.5)	

UCVA=uncorrected visual acuity; PL=perception of light; IQR=interquartile range

in the present study are similar to those reported in previous works. Both planned and unplanned patients achieved good visual results after MSICS. The findings of the present study reveal a UCVA of 20/70 or better in 96.2% (1,467 out of 1,526 patients) of the planned group and 94.7% (637 out of 673 patients) of the unplanned group at the six-week follow-up. No statistical difference was observed between the two groups regarding the last follow-up of UCVA.

At the six-week follow-up, the median postoperative astigmatism exhibited by the planned and unplanned groups were –1.0 (IQR –1.5 to –0.5) D in both groups (Table 2). This is more than the 0.86±0.62 D reported by Kongsap[13]. The mean surgical-induced astigmatism reported in previous studies following MSICS ranges from 0.8 D in Ruit et al.[8], 1 D from Muralikrishnan et al.[14], and 1.2 D from Gogate et al[11]. One reason for achieving the median postoperative astigmatism of –1 D in the present study compared to the other study could be that a larger incision size results in more postoperative induced astigmatism.

Besides the effectiveness of surgery for visual acuity improvement, the present study found hyphema to be the most common intraoperative complication in both groups. The incidence of hyphema was 5.9% (90 out of 1,526 patients) in the planned group and 8.2% (55 out of 673 patients) in the unplanned group. According to the findings, the incidence of posterior capsular tear with vitreous loss in the planned group and unplanned group was 0.9% (13 out of 1,526 patients) and 0.4% (three out of 673 patients), respectively. A posterior capsular tear without vitreous loss occurred in 3.3% (51 out of 1,526 patients) of the planned group during the operation and in 1.9% (13 out of 673 patients) of the unplanned group. When compared the intraoperative complications between the planned and unplanned groups, no statistically significant difference was revealed. This is more than 0.5% reported by Haripriya et al.[15], 0.8% reported by Behera et al.[16], 1.4% reported by Venkatesh et al.[17], while Ruit et al.[8] reported no significant difference. Six hundred seventy-three eyes (100%) in the unplanned group had an IOL implanted, but in the planned group, an IOL was implanted in 1,523 eyes (99.8%) and

deferred in three eyes. In these three eyes (0.2%), it was deferred because of poor capsular support.

Common early postoperative complications consisted of minimal hyphema and corneal edema, which improved within two weeks. In the present study, the incidence of postoperative hyphema in the planned and unplanned group was 9% (138 out of 1,526 patients) and 8.5% (57 out of 673 patients), respectively. Kamonporn & Pipat[18] reported a 4.35% incidence of hyphema, Sharma et al. reported a 5.5%[19], Kongsap reported a 6.2%[13], while Ruit et al. reported a 29.6% incidence of minor postoperative hyphema[8]. One reason for the comparatively low incidence of patients with intraoperative and postoperative hyphema in the present study could be due to a deep tunnel and scleral pocket incision. A scleral tunnel with an appropriate depth, adequate treatment with an electric cauterization, and if the bleeder was identified intraoperatively, anterior chamber formation with a large air bubble and suturing of the wound may have been responsible for the low incidence of postoperative hyphema. The findings of the present study revealed corneal edema to be the most common immediate postoperative complication in both groups. In the planned group, 138 cases were found, constituting 9% and 67 cases representing 9.9% in the unplanned group. Most of them cleared spontaneously by two weeks after the operation. There was no statistical difference in the early postoperative complications between patients in planned and unplanned groups.

One of the most serious complications after cataract surgery is endophthalmitis, with sight-threatening intraocular inflammation. Previously published incidence rates for acute postoperative endophthalmitis vary from 0.04% to 0.26%[20-24]. In the present study, none of the patients received intracameral antibiotics. One case of endophthalmitis, out of 2,199 (0.05%) was treated with pars plana vitrectomy (PPV), intravitreal and topical antibiotics. This patient achieved 20/70-2 vision at the six-week follow-up. This is comparable to the incidence rate of endophthalmitis without intracameral antibiotics reported by Haripriya et al., which was 0.07% to 0.08%[25], Bhatta et al. which was 0.09%[26], and lower than that of Ravindran et al., who reported an incidence of endophthalmitis after MSICS in 0.12% of cases[27]. Moxifloxacin has a broad spectrum of activity and a concentration dependent action mechanism. The intracameral use of this drug can help in reducing the risks of postoperative endophthalmitis in cataract surgery cases[28]. Routine prophylactic use of intracameral antibiotics is suggested as a cost-effective measure to improve the safety of MSICS[25].

The advantage of the present study was that it provided a long-term retrospective review of one surgeon and a single surgical technique in difficult situations. However, one limitation was that it involved a retrospective analysis. Furthermore, the patients under study did not have BCVA patients. Future studies should be randomized controlled trial or comparative study with a larger sample size and BCVA evaluation.

Conclusion

The present study demonstrated the favorable outcomes achieved with MSICS using Ruit technique. Both planned and unplanned cataract patients achieved good visual outcomes with a low rate of postoperative complications.

What is already known about this topic?

Previous studies showed that MSICS using Ruit technique is a safe and cost-effective method for cataract extraction, producing good visual outcomes with low complication rates. However, there have been no studies comparing surgical outcomes between patients scheduled for surgery and those who were not.

What does this study add?

There was no statistically significant difference in the visual results and complications between the planned and unplanned groups. The objective of unplanned cataract surgery was to reduce the barriers to access while improving the accessibility and availability of quality eye care services in rural and remote areas. An effective unplanned cataract surgery program would help to reduce the backlog and increase the cataract surgical rate and patient satisfaction with the service.

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Conflicts of interest

The author declares no conflict of interest.

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