

Manual small incision cataract surgery in dense cataract: Morocco comparative study

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ABSTRACT

BACKGROUND: The purpose of this study was to compare manual small incision cataract surgery (MSICS) with phacoemulsification and manual extracapsular extraction in terms of corneal edema, endothelial loss, and induced astigmatism.

MATERIAL AND METHODS: A prospective study carried out in the ophthalmology department of the military hospital of Rabat in Morocco, including 15 eyes of 15 patients with brown cataracts. All patients were operated on by the same surgeon: 5 by phacoemulsification (PKE), 5 by manual extracapsular extraction (EEC) via corneal incision, and 5 by MSICS via tunneled sclero-corneal incision. Each patient underwent pre-, intra- and post-operative evaluation including: 1 — measurement of astigmatism before surgery and 3 months after (after removal of EEC threads); 2 — specular microscopy before and 3 months after surgery; 3 — clinical assessment of corneal edema before and at each follow-up: 1st and 7th day, 1st and 3rd month; 4 — evaluation of operating time.

RESULTS: 9 men and 6 women were included. Mean age was 67 years. The mean axial length was 22.98mm. All surgeries were uneventful, and all patients were implanted in the capsular bag with a monofocal implant. Initial endothelial cell count was comparable in the 3 groups ($p = 0.48$). The endothelial loss was most significant in the PKE group (16%), followed by the EEC group (5.1%) and then the MSICS group (4.5%) ($p < 0.01$). The change in corneal astigmatism was most significant in the EEC group (2.1D), followed by the MSICS group (0.88 D), then the PKE group (0.65 D) ($p = 0.01$). In the PKE group, all patients showed moderate to severe corneal edema at 1st postoperative, and in 2 cases, the edema persisted at the 7th day and then regressed at the 1st and 3rd month. Only 2 cases of moderate edema at day 1 in the EEC group, and 1 case in the MSICS group, regressed at the 7th day. Phacoemulsification was the least time-consuming, with an average operating time of 13 minutes, compared with 28 minutes for MSICS and 34 minutes for EEC ($p < 0.01$).

CONCLUSION: MSICS is a technique that resembles manual EEC, with a self-sealing tunneled scleral-corneal incision that avoids a full-thickness corneal incision and, consequently, sutures at the end of the procedure. It requires a learning curve. Our results concur with most of the data in the literature. MSICS is a safe technique, but it remains little used in cataract surgery. We believe that it should be preferred in patients with dense cataracts.

KEY WORDS: dense cataract; MSICS; corneal edema; astigmatism; endothelial loss

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INTRODUCTION

The extracapsular cataract extraction (ECCE), which was performed for the first time by J. Daviel in 1747, has continued to be the preferred technique for cataract surgery. In 1967, Charles Kelman revolutionized cataract surgery when he introduced phacoemulsification (PKE) as an alternative approach to ECCE, and since then, it has been extensively used all over the world [1]. Because of difficulties associated with PKE in the developing world, alternative cataract surgical techniques such as sutureless manual small incision cataract surgery (MSICS) are gaining popularity. MSICS is associated with excellent outcomes with lower cost and average surgical time than phacoemulsification. In this prospective study, we aimed to compare, in a small sample of patients, the surgical and clinical results in terms of corneal edema, endothelial loss, and induced astigmatism between the three techniques: MSICS, PKE, and ECCE in dense cataracts.

MATERIAL AND METHODS

We included all the consecutive patients with brown cataracts during a 4-month period, from March 2022 to June 2022, in the Ophthalmology Department of the Military Hospital of Rabat, Morocco. PKE, ECCE, and MSICS were all performed by the same surgeon. The selection of the surgical approach was decided by the surgeon and patient with full information regarding the procedures.

The MSICS technique consisted of performing a superior limbic peritomy then a gentle cautery of the episcleral vessels. Then, a straight incision is made at the superior scleral level over a length of 7 mm, 1.5–2 mm posterior to the limbus. It extends 1 to 1.5 mm into the clear cornea. The tunneled incision has a trapezoidal shape, with an internal opening of 9–10 mm and a scleral opening of 7 mm. After capsulotomy, viscoelastic was injected above and behind the nucleus, and then it was dislocated

in the anterior chamber. Then, the nucleus was expelled by viscoexpression through the corneoscleral tunnel. The residual cortex is extracted by manual irrigation and aspiration. Finally, the implant is injected into the capsular bag. Then, the conjunctiva is closed with 1 or 2 Vicryl 8.0 sutures. The ECCE was performed through a large corneal incision (9–10 mm). For patients operated by PKE, we used the horizontal shop technique.

Each patient underwent a pre-, per- and post-operative evaluation, including measurement of total astigmatism before surgery and 3 months after (after removal of ECCE sutures), specular microscopy before and 3 months after, clinical evaluation of corneal edema, and assessment of the operating time. The statistical study was carried out on SPSS version 20 software. The non-parametric Wilcoxon and Kruskal-Wallis tests were used to compare the different variables. The value of $p < 0.05$ was considered statistically significant.

RESULTS

The study sample included 15 participants (6 females and 9 males) who had undergone either the ECCE or MSICS, or PKE techniques. There were five participants in each surgery technique. The study sample aged between 56 and 80 years with a mean age of 67 years. The preoperative characteristics of the three groups are shown in Table 1.

The main outcome was to measure the mean endothelial loss after surgery. It was estimated at 4.5% in the MSICS group, 16% in the PKE group, and 5.1% in the EEC group ($p < 0.01$). In PKE group, all the patients had postoperative edema, but none of them kept it at day 30. There was a statistically significant difference between the mean astigmatism change in the three groups at the end of the fourth week. We noted a 0.65 dioptre change in the MSICS group, 0.88 in the PKE group, and 2.1 dioptres in the EEC group ($p = 0.01$). There was

Table 1. Preoperative characteristics in the three groups

| | Group | | | p |
|--|--------------|--------------|---------------|------|
| | PKE (n = 5) | ECCE (n = 5) | MSICS (n = 5) | |
| Age [years] | 71 ± 5.5 | 66 ± 7 | 66 ± 6.7 | 0.33 |
| Axial length [mm] | 23.10 ± 0.78 | 23.02 ± 0.91 | 22.81 ± 0.46 | 0.92 |
| Total astigmatism [D] | 1.15 ± 0.54 | 1.75 ± 0.83 | 1 ± 1.21 | 0.37 |
| Endothelial cell count [cell/mm ²] | 2348 ± 335 | 2121 ± 574 | 2392 ± 322 | 0.48 |

PKE — phacoemulsification; ECCE — manual extracapsular extraction; MSICS — manual small incision cataract surgery

Table 2. Postoperative characteristics in the three groups

| | Group | | | p |
|---------------------------|-------------|--------------|---------------|--------|
| | PKE (n = 5) | ECCE (n = 5) | MSICS (n = 5) | |
| Induced astigmatism (D) | 0.88 | 2.1 | 0.65 | 0.01 |
| Endothelial cell loss (%) | 16 | 5.1 | 4.5 | < 0.01 |
| Corneal edema (%) | | | | |
| Day 1 | 100 | 40 | 20 | 0.03 |
| Day 7 | 40 | 0 | 0 | 0.29 |
| Day 30 | 0 | 0 | 0 | – |

PKE — phacoemulsification; ECCE — manual extracapsular extraction; MSICS — manual small incision cataract surgery

a significant statistical difference between the three groups concerning operative time. Phacoemulsification was the least time-consuming, with a mean time of 13 minutes, compared with 28 minutes for MSICS and 34 minutes for EEC ($p < 0.01$). Postoperative characteristics are shown in Table 2.

DISCUSSION

Phacoemulsification has been shown to be safe for the corneal endothelium in so-called easy non-brown cataracts. But in brown cataracts, endothelial loss can be major. The results of our study show that MSICS in dense cataract is as safe for the corneal endothelium as phacoemulsification in soft cataracts, and nearly as effective, and is much more economical. Thus, small-incision manual techniques are gaining popularity as a quick and relatively inexpensive technique for large-scale cataract management in developing countries and may be an alternative to phacoemulsification in areas where PKE machines are not available. It is also easier for a surgeon trained in ECCE surgery to master MSICS than phacoemulsification.

Chauhan's comparative examination of traditional and MSICS procedures revealed that small-incision cataract surgery using less advanced equipment had superior wound stability, less astigmatism, and quicker visual recovery. It demonstrated that the MSICS approach is safe since the posterior lens capsule is protected by stabilizing the nucleus against wire Vectis, and the corneal endothelium is protected by injecting enough viscoelastic material beneath it. Because the incision is short, the wound heals more quickly, and there is less postoperative astigmatism [2].

The ECCE technique is known to be most likely of inducing surgical astigmatism. A systematic analysis indicated that in two trials, surgically in-

duced astigmatism was higher in the ECCE group compared to MSICS. In the George et al. study, the mean induced astigmatism was 1.771.65D versus 1.10.95D ($p = 0.012$) [3], as in Gurung et al. study, individuals from the MSICS and ECCE groups, respectively, found astigmatism of less than 2D in 35.4% and 72.9% of the participants at eight weeks [4]. Furthermore, according to Pattanayak, a properly placed incision in the MSICS technique can be used to neutralize pre-existing astigmatism in MSICS [5].

Even though manual small-incision techniques have been thought to be associated with increased endothelial cell loss due to surgical maneuvers in the anterior chamber. The endothelial cell loss induced by the three techniques is similar, according to Georges, who compared the surgical outcomes of the three techniques [3].

No significant difference in percentage endothelial cell loss was found between the two techniques (MSICS and PKE). George reported a 5.41% endothelial cell loss at six weeks in the phacoemulsification group and 4.21% in the MSICS group ($p = 0.855$) [3]. Gogate reported a mean endothelial cell loss at one week of 16.1% in the phacoemulsification group and 12.2% in the MSICS group ($p = 0.06$). At six weeks, the percentage loss was 18.4% in the phacoemulsification group and 17.7% in the MSICS group ($p = 0.44$) [6]. But all these comparative studies were not made on brown cataracts as in our series.

Most studies of MSICS report transient corneal edema, which disappears by the first week. The Pune trial had 4.5% cases of postoperative corneal edema on the first day in the PKE group and 2% cases in the MSICS group [6]. Postoperative corneal edema was present in 62% of the conventional ECCE and in 48% of MSICS Ruit's study [7]. The edema was epithelial in nature and was in the upper part of

the cornea. The suggested cause of this edema was excessive manipulation and viscoelastic retention. The cornea was clear in all eyes after 6 to 8 weeks.

Contrary to the literature, MSICS takes much less time than phacoemulsification, even in the hands of highly experienced surgeons. In their comparative trials, Ruit et al. and Gogate et al. reported identical mean surgical times of 15.5 minutes for phacoemulsification and 8.5–9 minutes for MSICS. The comparison of operative time in our study would be biased because we measured the entire time from patient setup to the end of the procedure. In contrast, in these studies, they only counted the “surgical time”.

The limitations of our study are presented mainly by the small sample size. It only describes an individual’s experience within a short period. Also, due to a lack of resources, we did not perform corneal topography, which would have better estimated the preoperative and postoperative corneal astigmatism. Hence, there is a need for a larger investigation with more participants to evaluate, more specifically, all the surgical outcomes of the three techniques.

CONCLUSION

Despite the small number of participants, our results were similar to those found worldwide. MSICS has obtained excellent results in terms of corneal edema, induced astigmatism, and endothelial loss at a very low cost. Hence, its recommendation as the procedure of choice for hard and advanced cataracts is frequent in our context but also

in developing countries where the equipment remains limited by its low cost.

Conflicts of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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