

Original article

A novel nucleus extraction technique using a vectis in sutureless, manual, small-incision cataract surgery

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Abstract

Introduction: In manual, tunnel-incision cataract surgery, nucleus extraction has remained a crucial issue and a challenge. It is also the period when serious complications easily occur, especially for beginners and when the nucleus is large and dense. **Objectives:** To report a modified vectis technique for nucleus extraction in sutureless, manual, small-incision cataract surgery (MSICS) to improve the safety and ease of performance. **Materials and methods:** A novel nucleus extraction technique using a vectis in MSICS is presented. After capsulorhexis and hydrodissection, the nucleus is moved into the anterior chamber and extracted by pulling with a Sinsky hook and pressuring on the scleral bed near the posterior wound margin with an irrigating vectis. **Main outcome measures:** The operating time for the whole surgery and nucleus extraction, best corrected visual acuity postoperatively and complications during and after operation were recorded. **Results:** In a series of 1,180 eyes, the operating time for the whole surgery and nucleus extraction were 8 ± 3.4 minutes and 5.1 ± 4.6 seconds respectively. Among all the eyes, 88.98 % achieved a best corrected visual acuity of 5/10 or better two months postoperatively. The complications were posterior capsule rupture (4 eyes, 0.34 %) and transient corneal edema (12 eyes, 1.02 %). Neither vitreous loss nor dislocation of the nucleus into the vitreous was noted in the whole series of the surgery. **Conclusions:** We found that the “scleral bed” vectis technique for nucleus extraction improved the ease of performance, safety of MSICS, and did not require expensive instrumentation.

Keywords: sutureless, manual, small-incision, cataract surgery (MSICS), nucleus extraction, vectis

Introduction

The use of small incisions in modern cataract surgery has made the surgery faster and safer regarding postoperative healing and reduced complications such as suture-induced astigmatism. Currently, small

incision surgery is almost always used with phacoemulsification. Nevertheless, despite advances in equipment and technique, phacoemulsification remains an intimidating procedure for many ophthalmologists as it is one of the more difficult ophthalmic surgical techniques to learn. Instrumentation and disposable accessories for the surgery are expensive and becoming more

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so, and pose, especially the latter, serious obstacle for the surgery service in developing countries. In manual, tunnel-incision, cataract surgery, how to extract the nucleus from the anterior chamber safely and smoothly has remained a crucial issue and challenge. It is also the period when serious complications easily occur, especially for beginners and when the nucleus is large and dense. Manual sutureless techniques (e.g., mini-nuc and phacosection) (Ravindra, 2009; Rao and Lam, 2005; Blumenthal, 1994; Kansas, 1989; Kansas and Sax, 1988) have been developed as alternatives to overcome the obstacles. We present a new technique to deliver the nuclei with the irrigating vectis on the scleral bed.

Materials and methods

MSICS was performed using a novel vectis method in 1,180 eyes of 854 consecutive patients between January 2006 and December 2012. The mean age of the patients at surgery was 76.8 ± 6.5 years (range 59 to 92 years). Emery's classification yielded the following degrees of nucleus hardness: 40 eyes = 1; 156 eyes = 2; 253 eyes = 3; 321 eyes = 4; and 410 eyes = 5.

All the operations were performed by one experienced surgeon (Deng).

Surgical technique

A fornix-based conjunctival flap was made with the patient under topical anesthesia with Benoxil (oxybuprocaine) eyedrops. A 7.0 to 8.0 mm straight scleral incision 1.5 mm from the limbus was marked with calipers on the surface of the sclera, avoiding the major scleral vessels. A superficial scleral tunnel was dissected to clear the cornea with a crescent scalpel. The anterior chamber was entered with a keratome. The anterior chamber was filled with a viscoelastic material and then a 7.0 mm capsulorhexis was initiated with a cystitome modified from a 26G needle and completed by the cystitome itself. A can-opener capsulotomy was performed when the capsulorhexis was unsuccessful. Once the capsulorhexis was done, the wound was enlarged internally to 9.0 to 10.0 mm according to the nucleus size. Hydrodissection of the nucleus was done using

a balanced saline solution. The nucleus was dialed out of the capsular bag into the anterior chamber by engaging the equator with the Sinsky hook and Kuglen's hook alternately. When it came to the nucleus extraction, the procedure could be divided into three steps: first, the irrigating vectis was put on the scleral bed near the posterior flap; a Sinsky hook was inserted into the anterior chamber between the nucleus and the cornea, with the tip of the hook being embedded into center of the nucleus. Second, the end of the Sinsky hook was lifted to open the main wound in a fish-mouth shape and pressed down upon the irrigating vectis towards the vitreous cavity at the same time. Third, when the main wound was opened enough to allow the nucleus to come out, the nucleus was pulled with the Sinsky hook while the vectis was made to press upon the scleral bed. Finally, being driven by the increased intraocular pressure and pulled by the Sinsky hook, the whole nucleus was dislodged out of the eyeball without previous fragmentation in the anterior chamber or tunnel. The force on the scleral bed should be exerted continuously and slowly (Figure 1 - 3).

The nucleus has prolapsed into the anterior chamber. The irrigating vectis is put on the scleral bed near the posterior flap; the Sinsky hook is inserted into the anterior chamber between the nucleus and the cornea, with the tip of the hook being embedded into center of the nucleus.

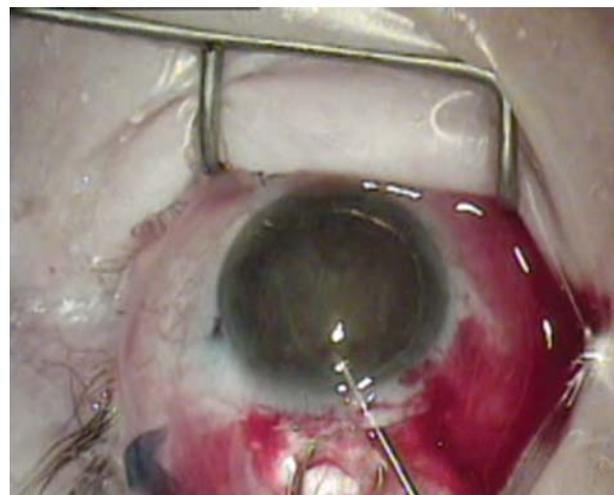


Figure 1

When the end of the Sinskey hook is lifted, the main wound is opened in a fish-mouth shape. The end of the Sinskey hook is lifted to open the main wound in a fish-mouth shape and the irrigating vectis is pressed towards the vitreous cavity at the same time. Figure 2

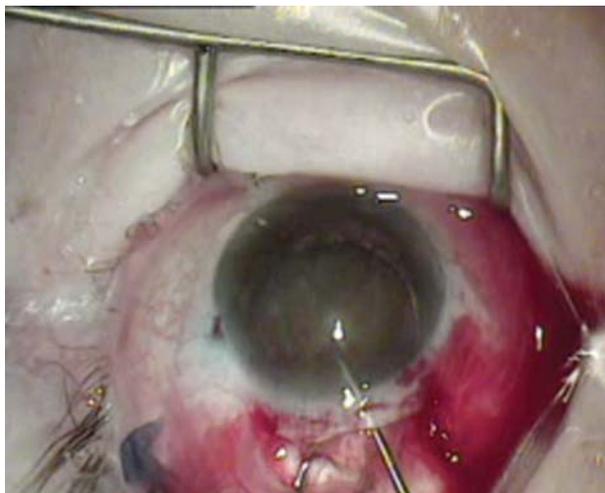


Figure 2

When the main wound is opened enough to allow the nucleus to come out, pull the nucleus with the Sinskey hook while pressuring the scleral bed with the vectis. Finally, being driven by the increased intraocular pressure and pulled by the Sinskey hook, the whole nucleus is dislodged out of the eyeball. Figure 3

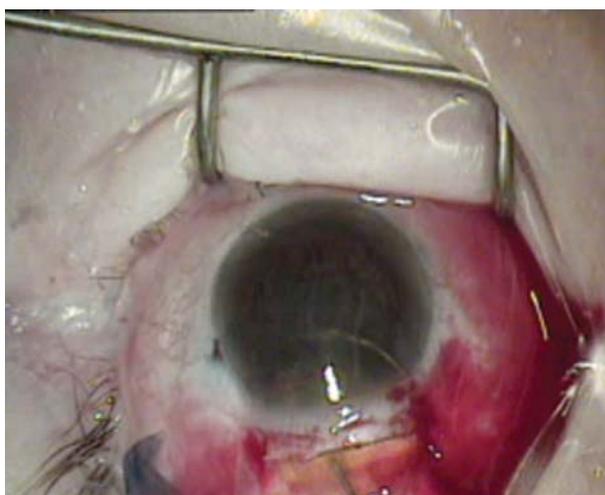


Figure 3

Throughout the procedure, special care is taken not to touch the iris or the endothelium. The residual epinucleus is hydroexpressed through the scleral incision with a Simcoe cannula. After cortex aspiration, a poly methyl methacrylate intraocular lens (IOL) is implanted in the capsular bag even when a capsulorhexis or can-opener capsulotomy is done. The intraocular lens is implanted and the incision checked to ensure it is self-sealing. No suture is placed. When the wound is not sufficiently watertight, one to two interrupted sutures are used.

Results

The mean follow-up was 3 ± 1.3 months (range two to five months). The mean operating time for the whole surgery was 8 ± 3.4 minutes (range 5 to 14 minutes). The mean operating time for the nucleus extraction using the vectis and Sinskey hook was 5.1 ± 4.6 seconds (range 2 to 23 seconds).

Posterior chamber IOLs were implanted in all cases (100 %) in the capsular bag despite a posterior capsular rupture (PCR) of no more than one quadrant in four cases. PCR occurred in four eyes (0.34 %). Vitreous loss or dislocation of the nucleus into the vitreous did not occur in any case. Transient corneal edema was noted in 12 eyes (1.02 %), which resolved within the first week.

In 1,050 eyes (88.98 %), a visual acuity of 20/40 or better was achieved two months postoperatively.

Discussion

The literature suggests that there are a variety of methods for nucleus extraction in sutureless MSICS. The most widely adopted technique is the irrigating vectis technique (Srinivasan, 2009) in which an irrigating vectis is inserted under the nucleus, with or without irrigating water, and then removed out of the eye. In addition, there are other techniques for nucleus extraction, such as the phacosandwich technique (Bayramlar et al, 1999), phacofracture technique (Kansas and Sax, 1988),

modified Blumenthal technique (Blumenthal, 1997), fish hook technique (the hook is made with a 1-ml syringe needle, and, during the operation, the hook is put behind the nucleus to hook out the nucleus from the eyeball), and so on.

All these techniques are practical and, among them, the irrigating vectis technique is the standard textbook method. However, each technique has its own limitations, such as being prone to cause a posterior capsule rupture, corneal damage and other serious complications when encountering a large nucleus and a relatively narrow anterior segment space, or when the patient's cooperation is not optimal.

The ideal extraction is supposed to be characterized by: **1.** minimally time consuming; **2.** minimal movements; **3.** no damage to the posterior capsule; **4.** no rigid contact with the corneal endothelium; **5.** no excessive stress directed to the zonule; **6.** no damage to the iris; **7.** and, most importantly, it must be easy to learn and control and be suitable for all rather than a part of the cases.

Hence, to explore a safe, effective and easy-to-learn extraction technique is of great importance for the vision-recovering service in China.

We have explored a practical nucleus extraction technique, a novel irrigating vectis technique, and have tried, in practice, to make it a proficient technique that gives good clinical results. This technique has advantages over the conventional irrigating vectis technique and other methods of nucleus extraction. During the nucleus extraction procedure in MSICS, only the tip of the Sinsky hook, which is small in size and occupies a minimal space of the anterior chamber, is put into the eyeball. The tip of the hook is blunt and small in size (1mm long only) so that it is less likely to injure the endothelial cells and the iris or the posterior capsule. The whole extraction procedure is performed under direct view since the Sinsky hook is inserted between the cornea and the nucleus, avoiding the possibility of blindly touching the vital structures. The vectis is put on the scleral bed near

the posterior wound margin without occupying the space of the anterior chamber instead of being inserted under the nucleus.

Due to the structure in the eyeball, it's very difficult for the force to be released safely and effectively in this narrow space, the anterior segment, without side injury to the zonule, capsule, endothelium of the cornea, iris and so on. The well-known instruments such as the irrigating vectis, used in the conventional way cannot solve the problem. This challenge can be solved by using this new vectis technique in which the vectis is put outside of the eyeball instead of being inserted under the nucleus, and thus avoiding occupying the space of the anterior chamber and inadvertently damaging the intraocular vital structures. What's more, surprisingly, the method is suitable for all cases including large, dense nucleus cases, for which the advantages can be exploited to the full.

The Sinsky hook in the right hand can be inserted into the essence of the nucleus to control the movement of nucleus. Normally it takes only five seconds for a nucleus to be safely dislodged out of the eyeball from the anterior chamber. This minimal trauma enhances a quick recovery postoperatively, especially when it comes to carrying out vision recovering activities of large scale in basic-level medical units. Nearly all corneas are totally transparent on the first day postoperatively.

We characterize this new vectis technique for nucleus extraction in the following ways: it's not high-class. Because of congenital limitations, astigmatism caused by making incision is inevitable, which in a certain extent restricts its application value. However, when it comes to carrying out massive vision recovering work in basic-level medical institutions that lack equipment and technique of phacoemulsification or splitting nucleus and when encountering cases of a thick, dense nucleus, etc, this technique has incomparable advantages. Meanwhile, if it could be regarded as a basic technique for all cataract surgeons, iatrogenic blindness caused by incorrect operation is going to



be avoided to a great extent - and minimizing the frustrations of many of us ophthalmic surgeons. Moreover, we believe that this technique will become popular in China as well as in other countries.

Conclusion: This novel vectis MSICS is a safe and effective method. It is easy to learn and use and only simple, inexpensive instruments are needed. It can be used to provide universal small- incision benefits without the expense and complexity of phacoemulsification.

References

Bayramlar H, Cekic O, Totan Y (1999). Manual tunnel incision extracapsular cataract extraction using the sandwich technique. *J Cataract Refract Surg*; 25: 312-5.

Blumenthal, M (1994). Manual ECCE, the present state of the art. *Klin Monbl Augenheilkd*; 205:266-70.

Blumenthal M (1997). Alternative to the

bimanual technique. *J Cataract Refract Surg*; 23:1433.

Kansas PG (1989). Modified pocket incision: a simplified technique for astigmatism control and wound closure. *J Cataract Refract Surg*; 15, 93-5.

Kansas PG & Sax R (1988). Small incision cataract extraction and implantation surgery using a manual phacofragmentation technique. *J Cataract Refract Surg*; 14:328-30.

Rao SK & Lam DS (2005). A simple technique for nucleus extraction from the capsular bag in manual small incision cataract surgery. *Indian J Ophthalmol*, 53, 214-5.

Ravindra MS (2009). Nucleus management in manual small incision cataract surgery by phacosection. *Indian J Ophthalmol*; 57:41-3.

Srinivasan A (2009). Nucleus management with irrigating vectis. *Indian J Ophthalmol*; 57: 19-21.

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