INTRODUCTION

Ophthalmic surgery, like all surgical disciplines, has evolved tremendously over the past 50 years. Technologies improve, and so do the procedures that implement them. Ophthalmology is a field that continues to look for improved methodologies to remove cataracts, to remove retinal pathologies, to decrease intraocular pressure more efficiently, to treat strabismus, and also in occuloplasty.(1)

The need for small incision has guided technological development in both anterior and posterior segment in ophthalmic surgery. The desire for small incision size is to reduce operating time, surgical trauma and postoperative discomfort.(2)

In cataract surgery, microincisional cataract surgery (MICS) Through bi-axial and co-axial phaco started to garner surgeon's interest by the year 2000. For the last few years, the number of studies done to determine the safety and efficacy of MICS has increased.(3)

In vitrectomy, 25 and 23 gauge vitrectomy surgeries have a role. They have not only a better postoperative appearance, but also they are more comfortable.[4]

Twenty Five gauge incision anterior segment surgery found helpful for both tumour biopsy and open angle glaucoma. 23-gauge vitrectomy cannulas can fixate dislocated posterior chamber intra-ocular lense through scleral fixation technique.[5]

Microincisional surgeries also has a role in treatment of glaucoma as in ex-press mini glaucoma shunt, endoscopic cyclophotocoagulation which used in treatment of refractory glaucoma and also in canaloplasty which treat open angle glaucoma.[6]

In strabismus, minimally invasive strabismus surgery (MISS) is done to decrease the chance for limbal ischemia and therefore less postoperative tissue scar.[7]

In occuloplasty, microincisional surgeries have a role as in endoscopic dacryocystorhinostomy in congenital nasolacrimal duct obstruction (NLDO) and have many advantages as less bleeding, less oedema, shorter operation time, less scarring and shorter recovery time.[8,9]

AIM OF ESSAY

The aim of essay is to review literature as regards the microincisional surgeries in ophthalmological field regarding their techniques advantages and disadvantages.

MICROINCISIONAL CATARACT SURGERY

Cataract surgery has experienced a large transformation during the last decades. This transformation has been in response to increased refractive requirements of patients and ophthalmic surgeons. New technology has allowed for unlimited development of the surgery technique and surgery tools. Refractive results of the surgery and new intraocular lens (IOL) technology has gained popularity among patients wanting to remove opaque lens. The need to improve surgical outcomes has led to further development of the surgery technique.The driving force of cataract surgery development was incision size reduction. The trend to diminish incision size contributed to the development of the phacoemulsification machine, lasers and surgical tools. This evolution of eye surgery had led to development of bimanual cataract surgery with incision size lower than 1.8 mm and co-axial MICS.[10]

MICS, generally defined as phacoemulsification performed through an incision of 2 mm or less, is now widely used with both bimanual and coaxial instrumentation. Bimanual MICS, typically performed through two 1.7 mm or smaller incisions, decreases induced astigmatism compared

with conventional small-incision cataract surgery (SICS) and improves visual performance in pseudophakic patients by preserving their corneal aberrometric patterns. Coaxial MICS, performed through an incision of approximately 2 mm, also demonstrates good results with low surgically induced astigmatism. A study in 2009 reported no significant difference in surgically induced astigmatism between the two microincision techniques.[11]

Bimanual Microincisional Cataract Surgery:

Microincision cataract surgery (MICS) was described first time by Jorge Alió in 2002 in Spain, as a new concept of cataract surgery based on bimanuality, new tools, fluidics and new concept of surgery technique. Agarwal ,Tsuneoka and co-workers described in parallel this surgical approach to cataract surgery with other denominations such as bimanual phacoemulsification-aspiration.[2,12]

In the bimanual technique, the anterior chamber irrigation is carried out with an instrument separated from the phacoemulsification/aspiration unit through two independent incisions smaller than 1.5 mm. At the end of the phacoemulsification hand piece, the needle that provides

ultrasound power does not carry the flexible silicone protector typical of conventional phacoemulsification.[13]

Despite the advantages of this surgical technique, it also exhibits short comings such as anterior chamber instability, limitation in the irrigation and vacuum level in relation to the smaller size of the instruments and the increased traumatism over the tense incisions exposed to the unprotected phacoemulsifier tip which distort and weakens them, leading to a possible late leak and inquestionably increasing the risk of endophthalmitis.[14]

The advantages of Bimanual MICS surgery technique over the previous techniques are due to smaller incision leading to low impact on corneal biomechanics, less surgically induced astigmatism (SIA), better postoperative corneal optical quality and lower risk of iris prolapse during the surgery. Also the small size of the instruments allows better intraocular view, protect the posterior capsule and maintain stable anterior chamber (AC) during whole surgery.[10]

Co-axial Microincisional Cataract Surgery(CO-MICS):

For the cataract surgery with Co-MICS procedure in which the incision is of 1.8 mm (Figure 1). Aviscoelastic is injected in the anterior chamber and paracentesis is performed at three and nine o'clock (for a superior main corneal incision). Subsequently, continuous circular capsulotomy is performed, followed by hydrodissection and hydrodelineation and ultrasound- assisted cataract aspiration, splitting the core in half. In the Co-MICS a 1.8 mm straight cannule is used (Figure 2). Subsequently, the cortex remains are removed with independent cannules, epithelial polishing is made at 360°, viscoelastic is injected in the capsular sac and there after the intraocular lens (IOL) is implanted with the injector. Finally, surplus viscoelastic is aspired, acetylcholine may be instilled to contract the pupil to a size smaller than the IOL optic and paracentesis is hydrated, verifying that the chamber is tight and with adequate intraocular pressure.[15]

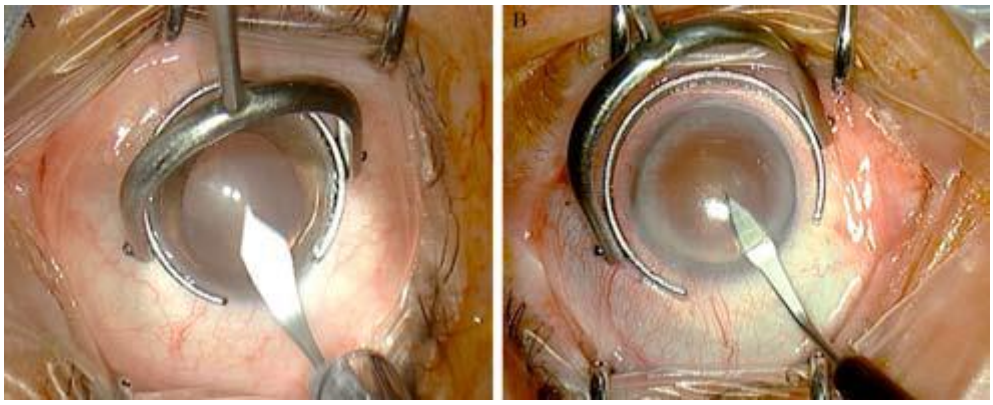

Figure 1: Performing the main incision: A. with a length of 2.8mm in conventional phacoemulsification; B. with a length of 1.8 mm in Co-MICS.[15]

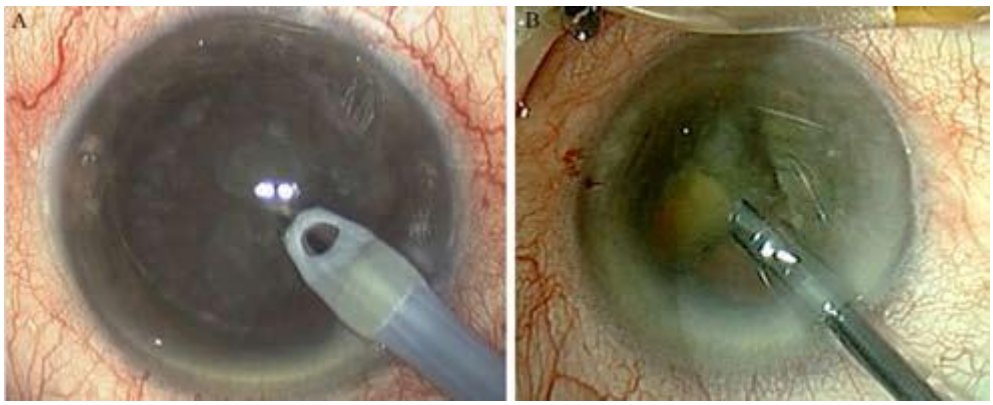

Figure 2: Inserting through the main incision the phacoemulsifier tip covered with the silicone protector: A. utilising the Microflow straight cannule for conventional phacoemulsification; B. utilising the 1.8 mm straight cannule for Co-MICS.[15]

The main advantage of this technique is that, in contrast with the bimanual technique, it utilises the same methods as conventional techniques but with a smaller incision size.

Therefore, the surgeon does not need to modify the surgical technique, its learning curve is short, in contrast with the bimanual technique.[16]

In addition, the flexible silicone protector that surrounds the phacoemulsifier needle adapts to the incision and does not alter its integrity during surgery. The relative disadvantages of the Co-MICS technique include the difficulty of eliminating the subincisional cortex and a diminished follow ability to the aspiration terminal, as the irrigation can mobilise the nuclear fragments, pushing them away from the phacoemulsifier tip.[13]

In an experimental study, Berdahl demonstrated that Co-MICS and standard phacoemulsification induce lower tension over the incision and therefore cause a smaller morphological alteration, leading to lower loss of fluid than the bimanual microincision surgery.[14]

Bi-MICS Technique

Bimanuality in MICS

Absence of the main incision facilitates planning of the two side small incisions. It is important to put incisions on the axis of the corneal astigmatism. Two incisions put on the axis of

90° spread symmetrical force of the corneal biomechanics. SIA by MICS is generally neutral. Proper incision planning and use of limbal relaxing incisions may lead to refractive neutrality of surgery and improve corneal image quality.[17]

Two side incisions may facilitate continuous curvilinear capsulorhexis (CCC). It is quite challenging to do incision of 1.5 mm while performing capsulorhexis. MICS capsulorhexis forceps help in tearing the capsule with ease. In case of complicated capsule tear, the angle and side of the forceps can be changed to enhance CCC.Great advantage of the bimanuality can be seen in the nucleus fragmentation. Hydrochopper with the hook help with mass breakdown and maintains distance of the posterior capsule from the phaco tip. Aspiration of the masses is much easier than in the standard technique.Two equal incisions give the opportunity to choose the better incision to implant the lens. While selecting the incisions for IOL implantation, the rule of the dominant incision to diminish the corneal astigmatism is followed.[18]

Incision

Diminishing incision size should minimize surgical trauma, diminishing the wound recovery time , minimizing

deformation of the cornea and inflammation of the eye. Idea of incision minimization provoked progress in cataract surgery. Surgery with incision under the 1.8 mm needs to be performed in non-standard coaxial way. Bimanuality provokes to open two symmetrical clear corneal incisions. Incision size symmetry allows to freely operate from each side. Access to each part of the anterior chamber is smooth. Performing the regular capsulorhexis is easy from right and left sides.[19,20]

To perform MICS incision calibrated knife is needed. Internal incision should be shorter than external one. Difference should be about 0.2 mm. Trapezoidal shape of the incision allow to perform surgery without corneal damage. Trapezoidal shape facilitates horizontal movements of the tools or phaco tip. Internal incision seals the wound and wider external incision facilitates movements. Corneal traumatism was eliminated by this way. There is one more advantage of the microincision: incision lower than 1.8 mm allows to close wound without any complication. This dimension of the incision is the self-sealing incision. They are closed after the surgery spontaneously or with small amount of hydratation. This is particularly important for the post syrgically induced astigmatism (SIA) and aberrations. The wound integrity and the

self-sealing properties of the MICS and coaxial incisions are currently one of the most important agents in the endophthalmitis prophylaxis.[19,20]

The MICS technique had advantages over the small-incision cataract surgery (SICS) technique in minimizing the destructive effect of the large incision size on the optical quality of the cornea.[21]

One more advantage of the small incision is intraoperative floppy iris syndrome (IFIS) reduction. Moore and Goggin describe MICS as the stable technique which can suppress floppy iris prolapse during surgery.[22]

Figure 3: Microincision cataract surgery capsulorhexis with Alió MICS forceps.[10]

Figure 4: Fine–Hoffman capsulorhexis forceps (MST, DC, USA).[10]

Figure 5: Alio's MICS capsulorhexis forceps (Katena Inc., NJ, USA).[10]

Phacoemulsification & Power Modulation

Phacoemulsification can be carried out using different techniques such as chop (horizontal or vertical), flip, divide and conquer, or using prechopper to crack the nucleus . Nucleus is divided minimally in four parts after prechopping. That's why there is no need to grove or divide nucleus in MICS. There are only four quadrants to break and aspirate. First hand is for

phacoemulsification handpiece. Unsleeved tip for break and aspirate masses in MICS are used. Phaco tip size and incision size should be selected to eliminate leakage in the incision. For 0.9 mm phaco tip the internal diameter of incision should be less than 1.2 mm (Figure 6).[10]

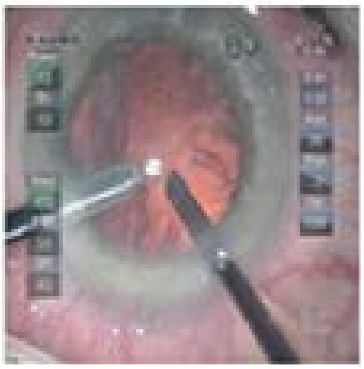

Figure 6: Microincision cataract surgery phacoemulsification with unsleeved 0.9 mm phaco tip.[10]

Second hand is for MICS irrigating chopper. This tool performs two basic tasks. Irrigating chopper provides fluid to the anterior chamber. High vacuum provoke high fluid demand, but only few irrigating choppers on the market fulfill MICS fluid conditions. Ensuring the constant supply of fluid to the eye is important (Figures 7,8).[10]

Figure 7: Fine irrigating chopper duet system (MST, DC, USA).[10]

Figure 8: Tsuneoka irrigating chopper tip 20 G (Asico LLC, IL, USA).[10]

To avoid wound burn, the phacoemulsification parameters in Bi-MICS are different than standard phaco since there is need to decrease the raise in wound temperature while marinating adequate energy. Ultrasound energy setting are usually lower than with standard phaco and with use of pulse mode, burst mode to produce less energy with more efficiency. In Bi-MICS the irrigating fluid comes through a 19 gauge or 20