

Original Article

## Global preferred practice patterns in manual small incision cataract surgery

Charmi Hareshkumar Madhani<sup>1</sup>, Kinjal Yogeshbhai Trivedi<sup>1</sup>, Purvi Raj Bhagat<sup>1</sup>

<sup>1</sup>Department of Ophthalmology, M & J Institute of Ophthalmology, Ahmedabad, Gujarat, India.

### ABSTRACT

**Objectives:** Manual small incision cataract surgery (MSICS) has become the surgery of choice in developing countries and setups with a high cataract load; being non-inferior to phacoemulsification, with minimum dependency on technology, and a shorter learning curve. There exist high variability and multiple differing personal preferences in its instrumentation and techniques. Through our study, we aimed to analyse different MSICS practice patterns across the globe to be able to summarise the commonly performed variations and carve a path for MSICS training programmes and help novice surgeons learn the state-of-the-art methods.

**Materials and Methods:** Ours was an online, questionnaire-based cross-sectional observational study. The Google form was floated among ophthalmologists through social media, globally. The preferences for each step of MSICS from the type of anaesthesia used to post-operative advice were asked and responses analysed.

**Results:** Out of 278 respondents, 234 (84.17%) ophthalmologists used peribulbar anesthesia; 214 (77.3%) preferred to do capsulorrhexis first followed by corneoscleral tunnel incision; 145 (52.15%) preferred frown incision; and 152 (54.7%) considered astigmatism management important during tunnel-making. The majority (226 [81.3%]) surgeons used anterior chamber maintainer. Viscoexpression, wire-Vectis, and irrigating Vectis were practiced by 122 (43.9%), 96 (34.5%), and 64 (23%), respectively. As for the intraocular lenses, 175 (62.9%) surgeons preferred non-foldable and non-premium while 65 (23.4%) used multifocal. Viscoimplantation was preferred by 256 (92.1%) surgeons. Only 13 (4.7%) surgeons sutured the tunnel at the end while a subconjunctival antibiotic-steroid injection was used by 166 (59.7%) surgeons.

**Conclusion:** Studying the variability in MSICS can help to carve future MSICS training programs and help novice surgeons to better perform the surgery.

**Keywords:** Manual small incision cataract surgery, Practice patterns, Cataract, Vectis, Anterior chamber maintainer

### INTRODUCTION

A cataract is one of the leading causes of moderate-to-severe visual impairment globally. In 2020, the Vision Loss Expert Group Data showed that an estimated 43 million people were blind and 295 million had moderate-to-severe visual impairment, and cataract was found to be the second most common cause of visual impairment surpassed only by uncorrected refractive errors.<sup>[1]</sup> Therefore, cataract surgery usually forms the major chunk of workload in most ophthalmic setups in the country. According to the National Blindness and Visual Impairment Survey 2015–2019 – Summary report, cataract surgical coverage (CSC) among cataract blinds (VA <3/60 in the better eye) was 93.2% (males 94.8% and females 91.9%). CSC among visually impaired (VA <6/18 in the better eye) due to cataract was 74.0%.<sup>[2]</sup> In

India, cataract surgical rate (CSR) (the number of operations per million people, per year) has increased significantly from only 700 in 1981–to 6000 in 2012. This is very close to the estimated CSR of 8000–8700 needed to eliminate the burden of blindness due to cataracts in India.<sup>[3–6]</sup>

Manual small incision cataract surgery (MSICS), phacoemulsification (phaco), and Femto phaco are the three most commonly practiced cataract surgeries. Results of a meta-analysis show that MSICS is non-inferior to phacoemulsification in terms of post-operative visual acuity and complications.<sup>[7,8]</sup> It is minimally dependent on technology and thereby eliminates the costs and maintenance of sophisticated machines. The learning curve is less steep in MSICS and surgeons who have mastered MSICS have been known to perform quicker and better phaco surgeries.

\*Corresponding author: Kinjal Yogeshbhai Trivedi, Department of Ophthalmology, M & J Institute of Ophthalmology, Ahmedabad, Gujarat, India. [kinjaltrivedi30@gmail.com](mailto:kinjaltrivedi30@gmail.com)

Received: 05 December 2021 Accepted: 18 January 2022 Published: 29 April 2022 DOI: 10.25259/GJCSRO\_6\_2021

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, transform, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms. ©2022 Published by Scientific Scholar on behalf of Global Journal of Cataract Surgery and Research in Ophthalmology

MSICS, therefore, is the surgery of preference in scarce resource developing countries and places with a high volume of cataracts.<sup>[9]</sup>

It has been found that the variability of the surgical technique of MSICS is quite high. Every surgeon has his/her own variation for each step of the surgery.<sup>[10-12]</sup> Training of MSICS also lacks standardization and uniformity due to these vast differences in techniques. Through our study, the first of its kind, we aimed to analyse different MSICS practice patterns across varied geographical regions to be able to summarise popular and most commonly performed variations in technique and carve a futuristic path for MSICS training programmes.

**MATERIALS AND METHODS**

Ours was a cross-sectional observational study approved by our Institutional Ethical Committee. All procedures followed were in accordance with the Ethical Standards of the Institutional Committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000. Various techniques of small incision cataract surgery were reviewed from the literature, on the basis of which an online Google form based questionnaire was designed and validated. The questionnaire was floated among ophthalmologists practicing in different setups and locations through social media, namely, Facebook, WhatsApp, and Telegram with implied informed consent. The survey was kept open for 4 months (August–November 2020). The questionnaire consisted of 25 questions. Apart from inquiry into general demographics and geographical area of their practice, the questions focused on the preferences in techniques for each step of MSICS beginning from the type of anesthesia to post-operative advice. Multiple responses to a question were allowed wherever applicable. An open-ended question for the preferred post-operative advice was also included in the study. The survey did not gather any personal identifying information from the respondent. The responses were compiled and analyzed using Microsoft Excel. We applied descriptive statistical analysis wherever applicable.

**RESULTS**

A total of 282 responses were gathered. Four surgeons did not perform MSICS making them ineligible for completing the survey further. Therefore, the final number of responses available for further analysis was 278. Out of these 278 participants, 68 participants (24.26%) were from 13 foreign countries and the rest 210 (75.53%) participants were practicing in India. Out of these Indian practitioners, maximum participants (98) were from Central India and the rest 39, 32, 28 and 13 participants were from Western, Southern, Northern and Eastern parts of India, respectively.

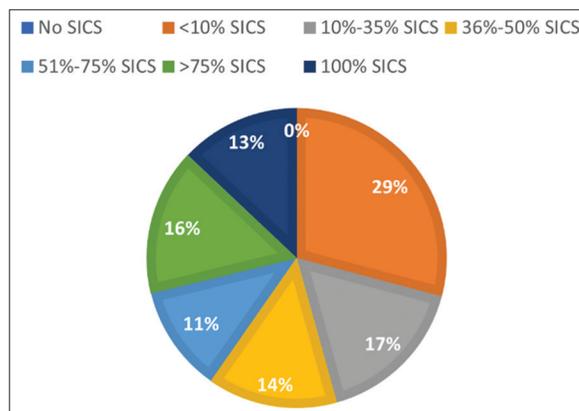
About 13% of participants (surgeons) admitted that MSICS comprised 100% of their total chunk of cataract surgeries while for 16% of surgeons, MSICS comprised more than 75% of their total chunk of cataract surgeries [Figure 1].

From 278 responses, we found that the majority 234 (84.17%) ophthalmologists performed the surgery under peribulbar local anesthesia [Figure 2].

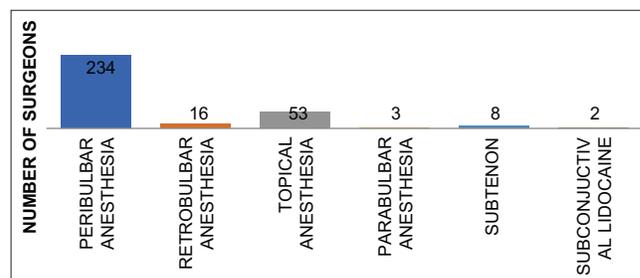
About 184 (66.2%) participants always performed a superior MSICS. Only 9 (3.23%) ophthalmologists used astigmatism as their guide to plan an incision with a steeper axis being the choice [Figure 3].

Out of 278 surgeons, 147 (52.9%) participants regularly used superior rectus bridle suture, 38 (14%) surgeons sometimes used it and 92 (33.1%) surgeons did not use it.

Out of 278 surgeons, 266 (95.7%) ophthalmologists did conjunctival peritomy first followed by tunnel incision and 11 (4.3%) surgeons made the direct transconjunctival incision. Out of 278 surgeons, 155 (56.1%) surgeons used bipolar cautery, 41 (15.1%) used ball-point cautery and 80 (28.8%) did not use cautery for haemostasis. Out of 278 surgeons, 214 (77.3%) ophthalmologists preferred to do capsulorhexis first rather than the corneoscleral tunnel and 63 (22.7%) surgeons preferred vice versa. Out of 278 surgeons, 194 (83.5%) participants put scleral incision



**Figure 1:** Proportion of manual small incision cataract surgery in practice.



**Figure 2:** Different types of anesthesia used while performing manual small incision cataract surgery.

whereas 35 (12.6%) and 10 (3.9%) participants use limbal and clear corneal incision, respectively, for the main port.

There has been observed a great amount of variability in the type/shape of the scleral incision. However, the majority of 145 (52.15%) surgeons preferred frown incision over any other shape from 278 responses that we gathered [Figure 4].

Out of 278 surgeons, 51 (18.3%) put side cuts in their incision, 60 (21.6%) surgeons occasionally put side cuts in their incision, and 167 (60.1%) surgeons did not use side cuts in their incision.

The range observed in the size of the scleral tunnel incision was 3–10 mm. Maximum surgeons (106 surgeons – 38.12%) preferred 6.0 mm tunnel incision [Table 1].

Out of 278 surgeons, 152 (54.7%) participants considered pre- and post-operative astigmatism while making a tunnel, 73 (26.3%) surgeons sometimes considered it and 53 (19.1%) surgeons did not take astigmatism into consideration.

The Crescent knife was the most favorite instrument for making a corneoscleral tunnel in our study. About 249 (89.56%) participants used it [Figure 5].

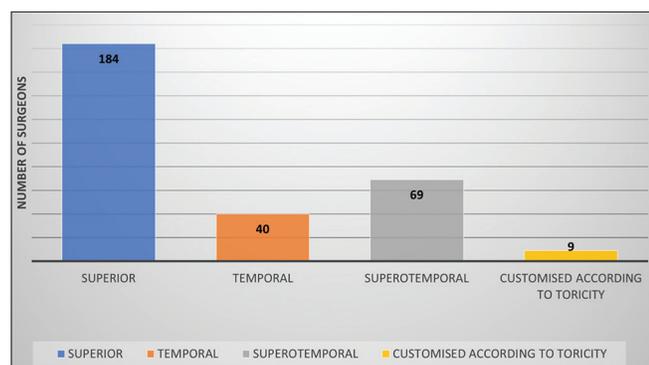


Figure 3: Variations in the site of the incision.

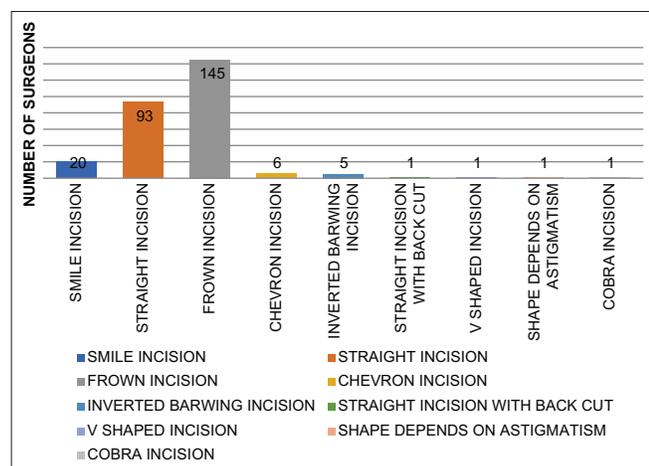


Figure 4: Variability in shape of the incision.

Out of 278 surgeons, 244 (87.8%) made side ports whereas 11 (4%) and 23 surgeons occasionally made and did not make side ports, respectively.

Out of 255 surgeons, 205 (80.39%) created single-side ports and, on the other hand, rest 51 (20%) surgeons used two of them.

In our study, out of 278 surgeons, only 111 (39.9%) surgeons regularly used trypan blue dye. 7 (2.5%) surgeons never used trypan blue dye for anterior capsular staining.

The majority of 261 (93.9%) surgeons used continuous curvilinear capsulorhexis (CCC) for making a capsular opening. 13 (4.7%) surgeons used the can opener technique and 3 (1.1%) surgeons use the envelope technique for capsular opening. Most of the surgeons (252–96.55%) who preferred CCC used bent 26G needles for the same [Figure 6].

Surprisingly, we found that 226 (81.3%) out of 278 surgeons used anterior chamber maintainer (ACM) and 26 (9.4%) surgeons never used ACM.

Out of 274 surgeons, 185 (67.5%) used only hydrodissection, 18 (6.6%) participants used only hydrodelineation, 69 (25.2%) surgeons used both hydrodissection and hydrodelineation, and very few – only 2 (0.7%) surgeons did not use any hydroprocedure in their MSICS.

Table 1: Variability in size of tunnel incision.

Average size of incision (mm)	Number of responses (n=278)
3	4
3.5	4
4	2
4.5	12
5	29
5.5	24
6	106
6.5	36
7	38
7.5	17
8	4
8.5	1
10	1

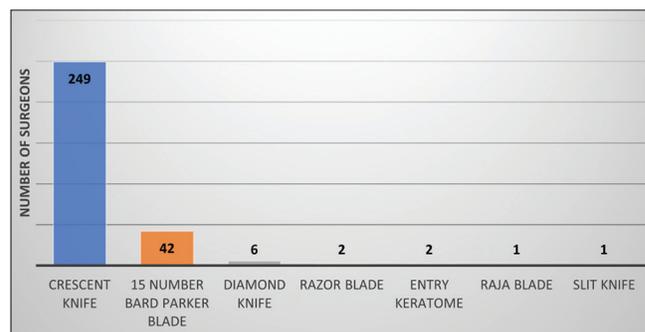


Figure 5: Various instruments used in making sclerocorneal tunnel.

We observed many interesting variations in nucleus delivery techniques including phaco-fracture, Ruit method, glide and and Sinsky hook. The top three preferences of surgeons in our study were viscoexpression, wire Vectis and irrigating Vectis which were practiced by 122 (43.9%), 96 (34.5%) and 64 (23%) surgeons, respectively, [Figure 7].

The majority of 175 (62.9%) participants preferred using non-foldable intraocular lenses (IOL) while performing their routine MSICS [Figure 8].

Most of them (175 surgeons – 62.9%) used non-premium IOLs in their practice. Only 65 (23.4%) surgeons used multifocal IOLs whereas fewer – 33 (11.9%) participants used toric IOL. The toric multifocal IOLs were practiced by only 17 (6.1%) surgeons.

Out of 278 surgeons, 106 (38.1%) surgeons used injectors while implanting foldable intraocular lenses while 62 (22.3%) surgeons never used injectors.

About 256 (92.1%), out of 278 surgeons used viscoimplantation technique for IOL and the rest 23 (7.9%) used hydroimplantation technique for implantation of the intraocular lens.

In our study, we found that very few (13 [4.7%]) surgeons always preferred suturing sclerocorneal tunnel at the end of the surgery and 106 (38.1%) surgeons rarely sutured sclerocorneal tunnel. The most common type of suture preferred by the surgeons was interrupted suture which was practiced by 60.8% of ophthalmologists in our study [Figure 9].

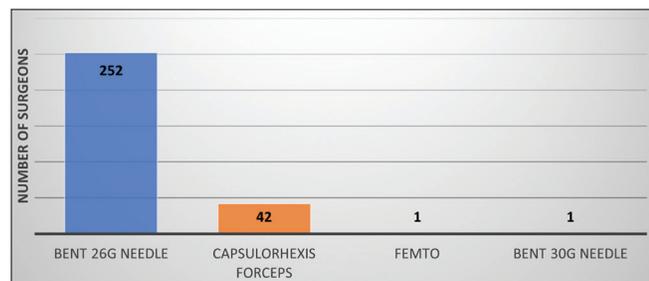


Figure 6: Instruments used to make capsulorhexis.

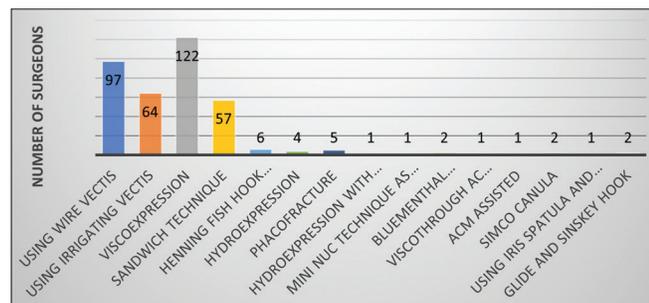


Figure 7: Different nucleus delivery methods practiced in manual small incision cataract surgery.

Multiple methods are practiced to close conjunctival peritomy – just apposition of edges without sutures and/or cautery is the most common method used (50.7% surgeons) [Figure 10].

Out of 278 surgeons, 245 (88.1%) surgeons did stromal hydration to close the side port, 2(0.7%) surgeons used a side port suture and 31 (11.2%) surgeons did not perform any additional manoeuvre to close the side port.

Out of 278 surgeons, 166 (59.7%) surgeons always gave the subconjunctival antibiotic-steroid injection, 42 (15.1%) surgeons occasionally used it and 70 (25.2%) surgeons did not use it at all.

### DISCUSSION

MSICS is a type of cataract surgery that has seen the greatest amount of surgical variations. Starting from 1984 by Girard *et al.*<sup>[13]</sup> many surgeons have contributed to the variability of techniques. In 1992, Michael Blumenthal developed the ‘minic’ technique.<sup>[14]</sup> Ruit *et al.* in 2000 described the funnel shaped scleral tunnel with V shaped capsulotomy.<sup>[15]</sup> Malik *et al.* developed a method to prevent endothelial cell loss using the ACM by an assistant during nucleus delivery.<sup>[16]</sup> A Double-nylon loop was developed by Kosakarn to divide the lens into small pieces in an attempt to reduce the size of the tunnel incision.<sup>[17,18]</sup>

Marking of the scleral incision is the first step in making a self-sealing corneoscleral tunnel. The site of this tunnel can be superior, temporal, or superotemporal. A temporal incision needs more lamellar dissection into the cornea to make it self-

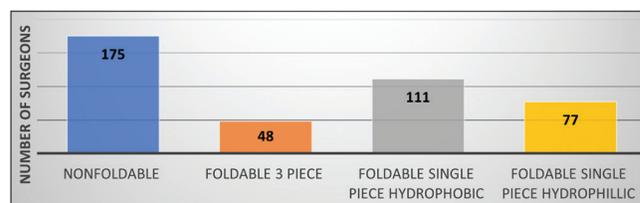


Figure 8: Different types of intraocular lenses used in manual small incision cataract surgery.

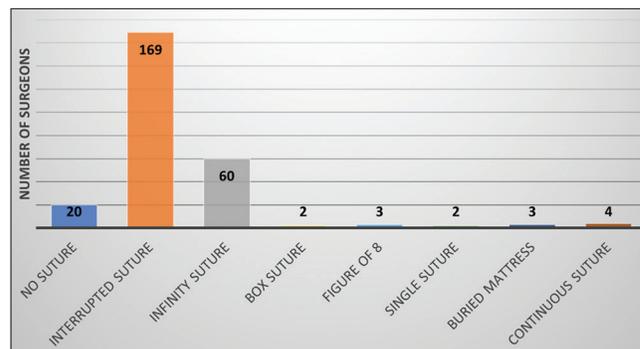
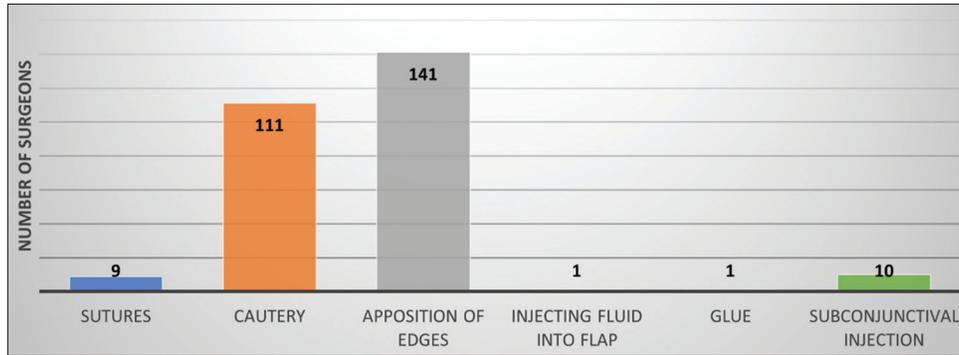


Figure 9: Type of suture used to close corneoscleral tunnel.



**Figure 10:** Variations in closure of conjunctival peritomy at the end of the surgery.

sealing but controls the surgically induced astigmatism better than a superior incision and provides better exposure in deep seated eyes. However, it increases the risk of post-operative endophthalmitis due to lack of protection from the superior lid.<sup>[10]</sup> In our study, we found that 184 (66.2%) participants preferred a superior MSICS which we assume is due to its preventive potential for endophthalmitis.

Various shapes of scleral grooves have been described in the literature. Among the commonly practiced ones, Chevron's inverted V shaped incision and Blumenthal side cuts have been found to cause minimal astigmatism.<sup>[10]</sup> In our study also, we observed great variability in the type and shape of the scleral incision. Most surgeons (145 [52.15%]) preferred a frown incision. Surprisingly, 53 (19.1%) surgeons did not take astigmatism into consideration when planning their incisions.

As described in the literature, nucleus expression can be performed broadly by two methods; irrigating hydrostatic pressure assisted devices and non-irrigating nucleus delivery methods. The former uses a Simcoe cannula and an irrigating lens loop while the latter uses either a non-irrigating lens loop or a bent needle in a fish-hook shape to impale and deliver the nucleus. In 1991, Corydon and Thin devised the viscoexpression technique for nucleus delivery<sup>[19]</sup> and subsequently, Bellucci *et al.* demonstrated the favorable results of viscoexpression.<sup>[20]</sup> Sandwich technique and modified fish-hook technique have been described by Bayramlar *et al.* and Hennig *et al.*, respectively,<sup>[21,22]</sup> and the two Sinsky method was developed by Rao and Lam for nucleus extraction from the capsular bag.<sup>[23]</sup> Blumenthal showed good surgical results using the ACM.<sup>[24]</sup> Several other surgeons later confirmed the same.<sup>[25,26]</sup> In our study also, a huge number of ophthalmologists – 226 (81.3%) used an ACM routinely. Many interesting variations in the nucleus delivery technique were also noted such as phacofracture, Ruit method, glide and Sinsky hook. The top three preferences of surgeons were viscoexpression and use of wire vectis and irrigating vectis.

Conventionally, non-foldable IOLs are used with MSICS but if cost is not a limiting factor, incision size is <3–4 mm and

patient's lifestyle demands, one can also implant a foldable IOL. IOLs can be implanted with or without an ACM, under viscoelastic or balanced salt solution.<sup>[27,28]</sup> In our study, 175 (62.9%) participants preferred using non-foldable and non-premium IOLs in their practice.

Although this study is one of the first ones, it does have some limitations. Despite efforts on vast dissemination of the survey, a limited number of responses could be gathered. Furthermore, in this study, we have not attempted to establish any correlation between a preferred technique of an individual surgeon, its post-operative outcome, and the duration of visual rehabilitation. This could be explored in further studies which could probably give us a better idea regarding the superiority of one technique over another.

## CONCLUSION

Studying and applying variability in the technique of MSICS will not only enrich our understanding of how this elegant surgery works but will also help novice surgeons to learn the state-of-the-art methods of performing its different steps. Analyzing the popular and most commonly performed variations in technique shall also help to carve a futuristic path for MSICS training programs.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

1. Vision. The International Agency for the Prevention of Blindness; 2020. Available from: <https://www.iapb.org/about/>

- history/vision-2020 [Last accessed on 2021 Oct 11].
2. The National Blindness and Visual Impairment Survey 2015-2019. Available from: <https://www.npcbvi.gov.in/writeReadData/mainlinkFile/File341.pdf> [Last accessed on 2021 Oct 11].
  3. Aravind S, Haripriya A, Taranum BS. Cataract surgery and intraocular lens manufacturing in India. *Curr Opin Ophthalmol* 2008;19:60-5.
  4. Honavar SG. Eliminating cataract blindness: Are we on target? *Indian J Ophthalmol* 2017;65:1271-2.
  5. Murthy G, Jain B, Shamanna B, Subramanyam D. Improving cataract services in the Indian context. *Community Eye Health* 2014;27:4-5.
  6. Dandona L, Dandona R, Anand R, Srinivas M, Rajashekar V. Outcome and number of cataract surgeries in India: Policy issues for blindness control. *Clin Exp Ophthalmol* 2003;31:23-31.
  7. Gogate P, Optom JJ, Deshpande S, Naidoo K. Meta-analysis to compare the safety and efficacy of manual small incision cataract surgery and phacoemulsification. *Middle East Afr J Ophthalmol* 2015;22:362-9.
  8. Ye Z, He SZ, Li ZH. Efficacy comparison between manual small incision cataract surgery and phacoemulsification in cataract patients: A meta-analysis. *Int J Clin Exp Med* 2015;8:8848-53.
  9. Ammous I, Bouayed E, Mabrouk S, Boukari M, Erraies K, Zhioua R. Phacoemulsification versus manual small incision cataract surgery: Anatomic and functional results. *J Fr Ophthalmol* 2017;40:460-6.
  10. Singh K, Misbah A, Saluja P, Singh AK. Review of manual small-incision cataract surgery. *Indian J Ophthalmol* 2017;65:1281-8.
  11. Kongsap P. Visual outcome of manual small-incision cataract surgery: Comparison of modified Blumenthal and Ruit techniques. *Int J Ophthalmol* 2011;4:62-5.
  12. Sharma U, Sharma B, Kumar K, Kumar S. Evaluation of complications and visual outcome in various nucleus delivery techniques of manual small incision cataract surgery. *Indian J Ophthalmol* 2019;67:1073-8.
  13. Girard LJ, Rodriguez J, Mailman ML. Reducing surgically induced astigmatism by using a scleral tunnel. *Am J Ophthalmol* 1984;97:450-6.
  14. Blumenthal M, Ashkenazi I, Assia E, Cahane M. Small-incision manual extracapsular cataract extraction using selective hydrodissection. *Ophthalmic Surg* 1992;23:699-70.
  15. Ruit S, Paudyal G, Gurung R, Tabin G, Moran D, Brian G. An innovation in developing world cataract surgery: Sutureless extracapsular cataract extraction with intraocular lens implantation. *Clin Exp Ophthalmol* 2000;28:274-9.
  16. Kps M. Malik's Technique of continuous 2% hydroxymethylcellulose (HPMC) infusion assisted nuclear delivery in manual SICS. *Delhi J Ophthalmol* 2015;26:190-1.
  17. Bernhisel A, Pettey J. Manual small incision cataract surgery. *Curr Opin Ophthalmol* 2020;31:74-9.
  18. Kosakarn P. Double nylon loop for manual small-incision cataract surgery. *J Cataract Refract Surg* 2009;35:422-4.
  19. Corydon L, Thim K. Continuous circular capsulorhexis and nucleus delivery in planned extracapsular cataract extraction. *J Cataract Refract Surg* 1991;17:628-32.
  20. Bellucci R, Morselli S, Pucci V, Bonomi L. Nucleus viscoexpression compared with other techniques of nucleus removal in extracapsular cataract extraction with capsulorhexis. *Ophthalmic Surg* 1994;25:432-7.
  21. Bayramlar H, Cekiç O, Totan Y. Manual tunnel incision extracapsular cataract extraction using the sandwich technique. *J Cataract Refract Surg* 1999;25:312-5.
  22. Hennig A, Kumar J, Yorston D, Foster A. Sutureless cataract surgery with nucleus extraction: Outcome of a prospective study in Nepal. *Br J Ophthalmol* 2003;87:266-70.
  23. Rao SK, Lam DS. A simple technique for nucleus extraction from the capsular bag in manual small incision cataract surgery. *Indian J Ophthalmol* 2005;53:214-5.
  24. Blumenthal M. Manual ECCE, the present state of the art. *Klin Monatsbl Augenheilkd* 1994;205:266-70.
  25. Sharma T, Dhingra N, Worstmann T. Audit of small-incision cataract surgery using an anterior chamber maintainer. *Eye Lond Engl* 2000;14:646-50.
  26. Chawla HB, Adams AD. Use of the anterior chamber maintainer in anterior segment surgery. *J Cataract Refract Surg* 1996;22:172-7.
  27. Urrutia IP, Matiz H, Garzon M, Rodriguez H, Morales ME. Biocompatibility and refractive errors of hydrophilic and hydrophobic intraocular lenses. *Invest Ophthalmol Vis Sci* 2004;45:340.
  28. Li Y, Wang J, Chen Z, Tang X. Effect of hydrophobic acrylic versus hydrophilic acrylic intraocular lens on posterior capsule opacification: Meta-analysis. *PLoS One* 2013;8:e77864.

**How to cite this article:** Madhani CH, Trivedi KY, Bhagat PR. Global preferred practice patterns in manual small incision cataract surgery. *Glob J Cataract Surg Res Ophthalmol* 2022;1:4-9.