

Half Minimally Invasive Strabismus Surgery (MISS): A single para-muscular approach to horizontal muscle strabismus surgery

Attiya Parveen, Farnaz Kauser, Abadan K Amitava, Naheed Akhtar

Purpose: Minimally invasive surgeries are gaining popularity. We compared two different approaches to rectus muscles: namely the standard para limbal (SPL) and the single para-muscular (SPM). **Methods:** Thirty-six patients planned for monocular horizontal strabismus surgery were block randomized to SPL and SPM approach. SPM approach involved a single para-muscular 10-mm conjunctival incision levelled at the inferior border of rectus muscle. We compared the post-operative grades of redness, congestion, chemosis, foreign body sensation, and drop intolerance at day 1, 2 weeks, and 6–8 weeks; scar visibility and success rates at 6–8 weeks and operation duration in minutes. We compared the results using Mann–Whitney *U*-test for inflammatory grades, Fisher’s exact test for proportions, and *t*-test for parametric measures. Significance was set at $P < 0.05$. **Results:** On postoperative follow-up at any time point, no significant difference was found on comparing inflammatory grades, scar visibility, and success rates. In terms of duration, SPL approach was on an average 21.5 minutes quicker than SPM ($P = <0.001$). **Conclusion:** The SPM is comparable to the SPL approach in terms of postoperative comfort and appearance, but takes significantly longer to accomplish.

Key words: Half MISS, single para-muscular (SPM), standard para limbal (SPL)

Over the years, larger incisions have yielded way to smaller or less visible ones, often self-sealing, and either needing no sutures or the application of tissue glues, and leading to shorter, more comfortable, and cosmetically superior postoperative course. Thus, for instance laparoscopic cholecystectomy is the preferred option for gall bladder removal, permitting same-day discharge.^[1] Meniscal repairs are managed with minimally invasive arthroscopic approaches.^[2,3] A fibroid uterus is often removed by laparoscopic hysterectomy, reportedly with less pain and shorter hospital stay compared to abdominal hysterectomy.^[4] The endoscopic dacryocystorhinostomy (DCR) is now rapidly replacing conventional DCR, permitting lesser anatomical disruption, with minimal bleeding and early rehabilitation.^[5,6]

Similarly, cataract surgery has rapidly moved from the intracapsular, now largely obsolete, to the extracapsular approach; the latter being refined into the sub-3-mm phacoemulsification and its cheaper cousin, the tunnel incision, both essentially permitting IOL placement, through suture-less approaches.^[7,8] Elsewhere, Micro-Invasive Glaucoma Surgery (MIGS),^[9–12] and small gauge vitreoretinal techniques have been shown to be effective and safe.^[13,14]

In strabismus, standard limbal and para-limbal conjunctival incisions have yielded to forniceal approaches to access the extra-ocular muscles to allow suture-less, cosmetically superior results.^[15,16] In 2007, *Mojon* popularized Minimally Invasive Strabismus Surgery (MISS), which basically

involved approaching the muscles through two small para-muscular incisions on the conjunctiva, deftly operating the underlying muscles through them; these did not necessitate sutural closure, were more comfortable, and led to less inflammation. *Mojon* subsequently used this approach for all kinds of strabismus surgeries: rectus muscle recessions, resections, plications, reoperations, retro-equatorial myopexies, transpositions, and oblique muscle recessions or plications.^[17] We have also demonstrated the benefits of MISS in one of our randomized, parallel-designed study, comparing it to a standard para-limbal (SPL) approach in patients of horizontal strabismus qualifying for symmetrical surgeries, and shown it to be less prone to inflammation, more comfortable, and cosmetically better.^[18]

Inspired by MISS, and given the flexibility, elasticity, and mobility of the conjunctiva in the young, along with the ability to manipulate the rectus muscle–tendon complex, we theorized that a single para-muscular (SPM) incision placed parallel and in level with the inferior edge of the horizontal rectus muscle should also permit the usual recession and resection surgeries; in a manner of speaking, a “half MISS” approach. We therefore designed a randomized study to compare this SPM approach with the SPL approach in horizontal strabismus in terms of duration, post-operative inflammation, and successful surgical outcomes.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

Cite this article as: Parveen A, Kauser F, Amitava AK, Akhtar N. Half Minimally Invasive Strabismus Surgery (MISS): A single para-muscular approach to horizontal muscle strabismus surgery. *Indian J Ophthalmol* 2022;70:613–8.

Access this article online

Website:

www.ijo.in

DOI:

10.4103/ijo.IJO_2059_21

Quick Response Code:



Institute of Ophthalmology, JNMC, Aligarh Muslim University, Aligarh, India

Correspondence to: Dr. Abadan K Amitava, Institute of Ophthalmology, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, Uttar Pradesh - 202 001, India. E-mail: akamitava@gmail.com

Received: 04-Aug-2021

Revision: 31-Aug-2021

Accepted: 11-Oct-2021

Published: 27-Jan-2022

Methods

After ethical clearance from Institutional Ethics Committee, 36 horizontal strabismus patients or their parents assenting/consenting and qualifying for monocular recession and resection surgery were recruited from June 2017 to June 2018. We excluded cases of less than 10 years of age—those unable to comprehend the study, or those with evidence of recent ocular surgery, or active ocular inflammation. After a detailed history and a thorough assessment including visual acuity, dry and wet retinoscopy, binocular status with Bagolini striated glasses, and strabismus measurements with prisms, patients were block randomized to SPM and SPL groups by a colleague not included in the study. Allocation was concealed in opaque envelopes, opened in the operation theater *after* the stage of cleaning and draping.

Surgical techniques

The SPL approach involved the standard tri-planar incision about 2 mm away from the limbus. Subsequent dissection towards the inferior fornix up to bare sclera provided access to the rectus muscles, which was then hooked using Green's hook. Thereafter, the desired amount of recession or resection was carried out and the conjunctival flap was repositioned using two 8-0 polyglactin sutures.

For the SPM approach, we placed two point-marks 10 mm apart along the conjunctiva just inferior and parallel to the inferior edge of the rectus muscle. With the help of an assistant, the conjunctiva was lifted up from these two point-marks, so as to raise a linear fold, which was incised neatly with a #11 Bard Parker blade [Fig. 1a]. The inferior

edge of the muscle was easily identified with a few brisk snips, [Fig. 1b], and the entire muscle was hooked onto a Green's muscle hook [Fig. 1c], ensuring its entirety by performing a pole test [Fig. 1d]. We proceeded to gently dissect the overlying conjunctiva, which was then retracted superiorly so as to expose the tip of the Green's hook [Fig. 1e], while locking Castroviejo forceps were then used to secure the superior and inferior limits of the insertion [Fig. 1e]. A second hook passed around the muscle tendon helped expose a rectangular length, on which the desired recession or resection was carried out [Fig. 1f-h]. At the conclusion of the muscle surgery, the conjunctiva was gently swept back into position using a moistened cotton bud. One or two 8-0 polyglactin sutures were used to anchor the conjunctiva to its place at the discretion of surgeon.

Postoperatively, we compared the graded (scoring nil to mild–moderate–severe from 0 to 3) inflammatory scores individually on: redness, congestion, chemosis, foreign body sensation (FBS), and drop intolerance (DI); and aggregating them into a total inflammatory score (TIS), each on day one, at week two and at 6–8 weeks. While at 6–8 weeks we also observed for the presence or absence of a visible scar from 1 m, and surgical success (defined as alignment within 10 PD of orthophoria). Duration of surgery in minutes, when first incising the drape till the placement of the eye-dress, was also compared.

Statistical analysis

Outcomes were compared between the two groups using Student's *t*-test for continuous variables, Mann–Whitney U test for graded outcomes, and Chi-square test (Fisher's Exact

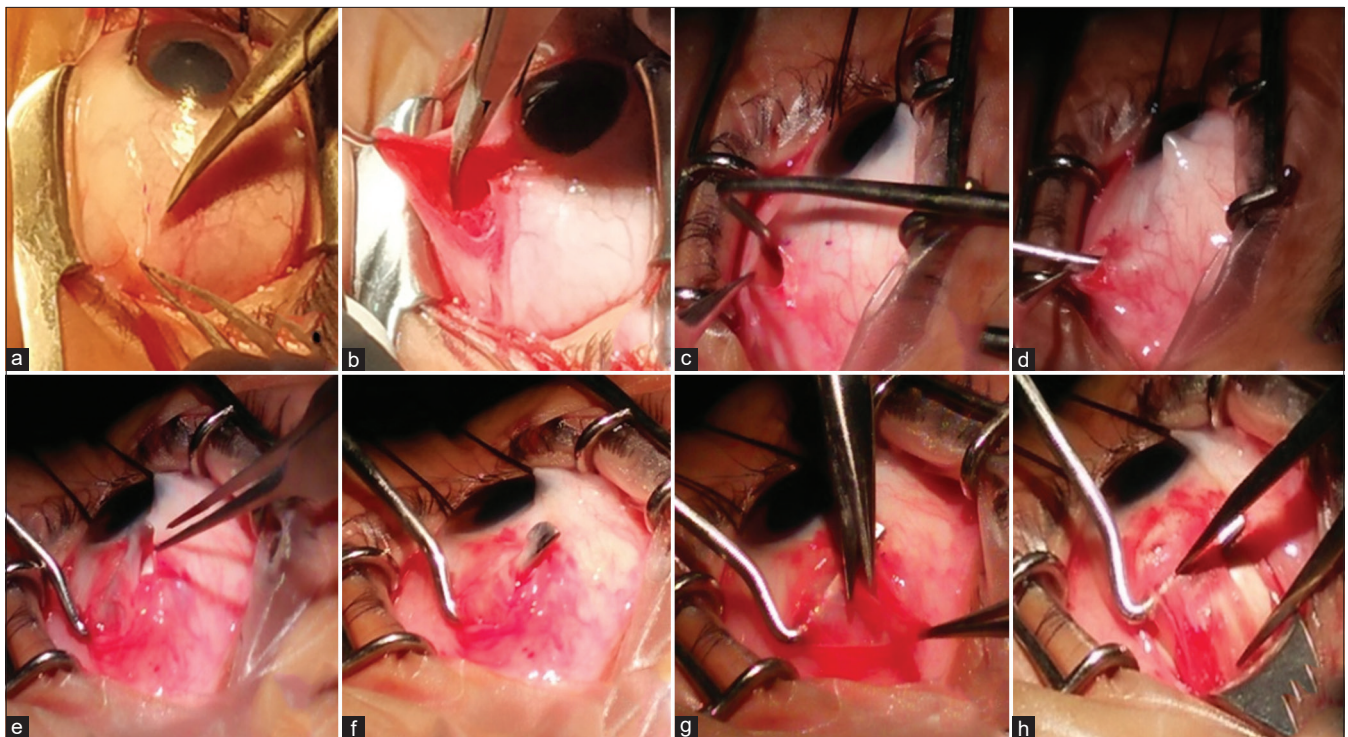


Figure 1: Steps of Single Para-muscular Approach. (a) Linear conjunctival incision along the inferior edge of the lateral rectus; (b) Blunt dissection through the conjunctiva; (c) Muscle hook being passed under the lateral rectus insertion; (d) The pole test confirming that all the muscle insertion is hooked; (e) The conjunctiva has been retracted over the muscle hook; (f) The muscle has been exposed; (g) Check ligaments have been excised; (h) The muscle has been exposed to perform the resection

method) for proportions or counts. Confidence intervals have been quoted where possible. Statistical significance was set at $P < 0.05$.

Results

Thirty-six patients were block randomized, with 18 each in SPL and SPM groups. The demographics and clinical characteristics are shown in Table 1. Overall, 21/36 were females, whereas 24/36 comprised cases of acquired strabismus.

Preoperative clinical and surgical characteristics including best corrected visual acuity (BCVA) in logMAR, quantum of horizontal deviation, surgical target, amount of recession and resection are described in Table 1.

Inflammatory scores

At no point in follow-up, any significant differences between groups were found on individual inflammatory scores or TIS: all P values > 0.05 on Mann-Whitney U test [Table 2]. Comparison of the inflammatory grades (according to TIS) on the postoperative follow-ups showed similar distribution in both the groups [Table 3]. Most patients were in the category of moderate inflammation on postoperative day one and in category of mild inflammation in the subsequent follow-ups at 2 weeks and 6–8 weeks.

Scar visibility

At 6–8 weeks, scar visibility was exactly comparable being 3/18 cases in each group [Table 4].

Surgical success

Success rate at 6–8 weeks was found to be similar: 16/18 in SPM versus 15/18 in SPL [Table 4]. The mean \pm SD postsurgical deviation at 6–8 weeks was more in SPL group than in SPM group, but the difference was statistically not significant. (P values > 0.05) [Table 4]. On comparing success rate among esotropes and exotropes at 6–8 weeks, we found no significant differences [Table 4].

Time taken for surgery

SPM approach took a mean of 43.6 minutes, whereas SPL approach was over in 22.1 minutes: the former taking on average 21.5 ± 0.71 minutes longer than SPL [Table 4].

Discussion

In patients of horizontal strabismus operated monocularly by recession–resection, we found no significant differences in grades of postoperative inflammation [Table 3], scar visibility, and success rate between patients operated by SPL approach compared to SPM [Table 4].

Table 1: Group-wise baseline demographic and preoperative clinical and surgical characteristics of the patients

Features	Randomized groups	
	Standard Paralimbal ($n=18$)	Single para-muscular ($n=18$)
Gender as number (%): Male: Female	6 (33.3): 12 (66.7)	9 (50): 9 (50)
Age in years: Mean \pm SD	21.50 \pm 6.04	21.00 \pm 4.98
Age at onset (years): Mean \pm SD	3.35 \pm 4.41	5.89 \pm 5.62
Strabismus duration: Mean \pm SD	18.06 \pm 7.40	15.11 \pm 6.94
Esotropia: Exotropia: number (%)	10 (55.6): 8 (44.4)	7 (38.9): 11 (61.1)
Congenital: Acquired: number (%)	7 (38.9): 11 (61.1)	5 (27.8): 13 (72.2)
Number of patients with previous interventions		
Spectacle usage	3	1
Strabismus surgery	1 (in the nonrecruited eye)	0
BCVA (logMAR)		
Operated eye	0.97 \pm 0.75	0.94 \pm 0.83
Nonoperated eye	0.07 \pm 0.11	0.06 \pm 0.12
Fixation behavior: number (%)		
Foveal	4	4
Eccentric	14	14
Amblyopia: number (%)		
No	4	4
Mild-moderate	3	3
Dense	11	11
Horizontal deviation: PD		
Esotropes	36.50 \pm 13.55	50.71 \pm 8.36
Exotropes	44.38 \pm 9.42	40.91 \pm 8.31
Surgical target (PD): Mean \pm SD		
Esotropes	35.50 \pm 13.83	45.00 \pm 5.77
Exotropes	47.50 \pm 10.35	44.55 \pm 6.50
Recession amount (mm): Mean \pm SD		
Esotropes (for MR)	4.95 \pm 0.98	5.36 \pm 0.89
Exotropes (for LR)	9.00 \pm 0.93	8.41 \pm 1.09
Resection amount (mm): Mean \pm SD		
Esotropes (for LR)	7.25 \pm 2.09	8.86 \pm 0.63
Exotropes (for MR)	6.69 \pm 0.96	6.50 \pm 0.74

Table 2: Group-wise comparison of individual and total Inflammatory scores (TIS) at follow-up (P on Mann-Whitney U test)

Inflammatory scores* median (range)	Redness		Congestion		Chemosis		Foreign body sensation		Drop intolerance		Total Inflammatory Score#	
	SPL	SPM	SPL	SPM	SPL	SPM	SPL	SPM	SPL	SPM	SPL	SPM
Postop day 1	2 (1-3)	2 (1-3)	2.5 (2-3)	3 (2-3)	1 (1-2)	1 (0-2)	1 (1-2)	1 (0-2)	1 (0-1)	0 (0-1)	8 (6-11)	7 (4-11)
P	0.84		0.79		0.31		0.25		0.25		0.35	
Week 2	1 (0-2)	1 (0-2)	1 (1-2)	2 (1-2)	0 (0-1)	0 (0-1)	1 (1-2)	1 (0-1)	0 (0-1)	0 (0-1)	4 (2-6)	3.5 (1-6)
P	0.17		0.26		0.79		0.18		1.00		0.48	
Week 6-8	0 (0-1)	0 (0-1)	1 (0-2)	1 (0-2)	0 (0-1)	0 (0-0)	1 (0-1)	0.5 (0-1)	0 (0-1)	0 (0-1)	2 (0-3)	1 (0-4)
P	0.79		1.00		0.79		0.79		0.79		0.58	

*Score given as 0 (nil), 1 (mild), 2 (moderate), and 3 (severe) for each inflammatory variable. #Total Inflammatory Score will range from 0 to a maximum of 15

Table 3: Group-wise distribution of the total inflammatory score (TIS) at follow-up visits

Follow-ups	Inflammatory grade*: n (%)	Randomized groups		P (Fischer's exact)
		Standard paralimbal (n=18)	Single para-muscular (n=18)	
Day 1	Nil	0	0	0.21
	Mild	0	3 (16.7)	
	Moderate	17 (94.4)	13 (72.2)	
	Severe	1 (5.6)	2 (11.1)	
Week 2	Nil	0	1 (5.6)	1.00
	Mild	16 (88.9)	15 (83.3)	
	Moderate	2 (11.1)	2 (11.1)	
	Severe	0	0	
Week 6	Nil	1 (15.6)	2 (11.1)	1.00
	Mild	17 (94.4)	16 (88.9)	
	Moderate	0	0	
	Severe	0	0	

*Inflammatory grades are according to the total inflammatory scores: 0 (nil), 1-5 (mild), 6-10 (moderate), and 11-15 (severe).

Table 4: Group-wise comparison of the postoperative outcome variables at 6-8 weeks

Outcome Variables At 6-8 weeks	Randomized group		P (Fischer's exact)
	Standard paralimbal n=18	Single para-muscular n=18	
Scar visibility n (%)			1.00
Not visible	15 (83.33)	15 (83.33)	
Visible	3 (16.66)	3 (16.66)	
Success rate* n (%)			1.00
Overall	15 (83.33)	16 (88.9)	
Esotropes (n=17)	8 (80)	6 (85.71)	
Exotropes (n=19)	7 (87.5)	10 (90.91)	
Post surgical deviation (PD)			P (t-test)
Mean±SD	6.17±6.07	5.22±7.37	0.42
Mean difference (95% CI)	0.94 (-3.63 to 5.52)		
Time taken for surgery (Minutes):			P (t-test)
Mean±SD	22.10±1.90	43.60±2.34	
Mean difference (95% CI)	21.5±0.71 (20.1 to 22.9)		

*Surgical success means the orthotropia of ≤ 10 PD at 6-8 weeks follow up

Importantly, compared to the SPL, the SPM approach took on average significantly longer time by 21.5 minutes [Table 4]. This is likely due to the SPM being a novel approach; it is likely that with more familiarity this difference would decrease.

We did not find any study with such an approach, although there are numerous studies comparing fornix-based, limbal, and para-limbal approaches with MISS.

Mojon (2007) compared MISS with limbal approach, in a prospective study with a nonconcurrent retrospective comparison group.^[19] VA decreased at postoperative day 1 in both groups, but the decrease was less pronounced in MISS group ($P < 0.001$). Lid swelling was present at day 1 but more frequently in limbal group, five out of 24 (95% CI 9% to 41%) versus zero out of 25 in MISS group (95% CI 0% to 13%). Final alignment, BSV, refractive changes, and complications

(allergic reaction, dellen) showed similar distribution. He concluded that MISS has superior immediate postoperative results. Long-term results were similar in both the groups.

Merino Sanz *et al.*^[20] conducted a retrospective study comparing MISS with fornix approach in horizontal strabismus operations. They included 16 patients, requiring symmetrical surgery of medial or lateral recti of age less than 12 years. MISS was performed in one eye and fornix approach was used in the other eye. Mean age was 6.75 ± 3.02 . They compared pre and postoperative VA, conjunctival hyperemia, swelling, and operating time. Preoperative VS was 0.77 in MISS and 0.80 in control group. On postoperative day 1, it was 0.83 in MISS and 0.76 in control group. No significant difference was found in conjunctival hyperemia on postoperative day 1 and week 1 after surgery. Interestingly, they report no significant difference in the operating time, being 14.43 minutes in MISS and 12.37 minutes in control group.

In our study, there is a significant difference in operating time between the two groups. SPM took on average 21.5 minutes longer than SPL. It may be because of being a novel approach it was less practiced as compared to para-limbal approach. Understandably, half an access compared to MISS would involve more maneuvering. In a study by Pilar Merino, the operating surgeons had had 4 years of experience making them compatible with the skilled procedure.

Nermeen in his prospective study compared MISS with fornix-based incision.^[21] He included 60 muscles of 50 eyes of 30 patients. He compared field exposure, final incision size, operative time, postoperative angle of deviation and postoperative conjunctival swelling, and visibility of incision in primary gaze, categorized as hardly visible, discrete, moderate, and severe. Field exposure was adequate in the fornix-based incision, whereas exposure was poor in MISS group. Incision size in MISS (size of muscle displacement minus 1 mm) ranged from 4.0 to 8.0 mm. As for fornix-based incision, size was within 4.5–8.0 mm. Akin to us, the operative time was longer in MISS (51.79 ± 6.39 min) than fornix-based incision (30.71 ± 6.46). Postoperative conjunctival signs (swelling and incision visibility) were related to size of incision. It was noted that with small-sized incisions (<4 mm), the fornix based had better results. However, with medium-sized incisions (4–6 mm), the two approaches had comparable results. MISS had favorable outcomes with longer incisions (>6 mm).

Forniceal or para-forniceal incisions, being midway between the muscle insertions, allows access to both the adjacent recti, while avoiding injury to their bellies, and ensuring conjunctival coverage over the operated muscle after surgery, causes less visible scarring and postop discomfort, and provides an advantage to operate on more than one adjacent muscle. However, it has major disadvantages of profuse bleeding, difficulty to perform in children, due to the thick Tenon's capsule, and in those with inelastic or scarred conjunctiva where tears may be common. While in SPM approach there is an advantage of easy and instant access to the muscle with less tissue and episcleral vessel dissection providing early healing and less bleeding and can be performed in children with thick tenon's also. The limitations are risk to muscle belly and difficulty to perform in scarred conjunctiva.

Richa (2018), from our center, in a parallel designed prospective study compared MISS with para-limbal approach.^[18] A total 28 eyes of 14 patients were randomized and, much like our study, post-operative redness, congestion, chemosis, FBS and DI, on a graded scale of 0 to 3 were compared at day 1, week 2–3 and week 6. Similar to our study, all individual scores were also added to get TIS and that was also compared. She noted significant difference in FBS and TIS on post-operative day 1, favoring MISS. At 2–3 weeks redness, congestion, FBS, and TIS were significantly less in MISS eye ($P < 0.05$). At 6 weeks, redness and TIS were significantly less in MISS eye ($P < 0.05$) again favoring MISS. It was noted that MISS took more time to complete (40.4 ± 7.98) than para-limbal approach (29.6 ± 5.37). At final follow-up significant scarring was noticed in all patients who underwent para-limbal approach, whereas it was present in nine patients of MISS group, but the difference was not significant ($P = 0.09$).

Conclusion

The result of our study suggests that the postoperative course after the SPM approach is similar to the SPL one. Importantly, the SPM took significantly longer by around 20 minutes, but this is likely to even out given more experience and skill over time. We propose that the SPM approach, though not showing evidence of superiority, does allow an alternative conjunctival approach, which increases the option in a surgeon's armamentarium. Surgeons need to explore newer and novel approaches to further the evolution of strabismus surgery.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- Kim SS, Donahue TR. Laparoscopic cholecystectomy. *JAMA* 2013;310:812-20.
- Thorlund JB, Englund M, Christensen R, Nissen N, Pihl K, Jorgensen U. Patient reported outcomes in patients undergoing arthroscopic partial meniscectomy for traumatic or degenerative meniscal tears: Comparative prospective cohort study. *BMJ* 2017;356:j356.
- Billières J, Pujol N; U45 Committee of ESSKA. Meniscal repair associated with a partial meniscectomy for treating complex horizontal cleavage tears in young patients may lead to excellent long-term outcomes. *Knee Surg Sports Traumatol Arthrosc* 2019;27:343-8.
- Garry R, Fountain J, Mason S, Napp V, Brown J, Hawe J, *et al.* The eVALuate study: Two parallel randomised trials, one comparing laparoscopic with abdominal hysterectomy, the other comparing laparoscopic with vaginal hysterectomy. *BMJ* 2004;328:129.
- Sandeep Bharangar S, Singh N, Lal V. Endoscopic endonasal dacryocystorhinostomy: Best surgical management for DCR. *Indian J Otolaryngol Head Neck Surg* 2012;64:366-9.
- Wasl H, Lubbe D. Endoscopic dacryocystorhinostomy (DCR) surgical technique. *Open Access Atlas of Otolaryngology, Head and Neck Operative Surgery*. 2018. p. 1-11.
- Venkatesh R, Tan CS, Sengupta S, Ravindran RD, Krishnan KT, Chang DF. Phacoemulsification versus manual small-incision cataract surgery for white cataract *J Cataract Refract Surg* 2010;36:1849-54.
- Linebarger EJ, Hardten DR, Shah GK, Lindstrom RL.

- Phacoemulsification and modern cataract surgery. *Surv Ophthalmol* 1999;44:123-47.
9. Macher T, Haberle H, Wachter J, Thannhauser C, Aurich H, Pham DY. Trabecular microbypass stents as minimally invasive approach after conventional glaucoma filtration surgery. *J Cataract Refract Surg* 2018;44:50-5.
 10. Agrawal P, Bradshaw SE. Systematic literature review of clinical and economic outcomes of micro-invasive glaucoma surgery (MIGS) in primary open-angle glaucoma. *Ophthalmol Ther* 2018;7:49-73.
 11. Soohoo JR, Seibold LK, Radcliffe NM, Kahook MY. Minimally invasive glaucoma surgery: Current implants and future innovations. *Can J Ophthalmol* 2014;49:528-33.
 12. Wecker T, Jordan JF. Minimally invasive glaucoma surgery using trabectome. *Klin Monbl Augenheilkd* 2015;232:303-9.
 13. Grosso A, Charrier L, Lovato E, Panico C, Mariotti C, Dapavo G, *et al*. Twenty-five gauge versus 23 gauge vitrectomy in the management of macular diseases: A comparative analysis through a Health Technology Assessment model. *Int Ophthalmol* 2014;34:217-23.
 14. Kychenthal A, Dorta P. 25-Gauge lens-sparing vitrectomy for stage 4A retinopathy of prematurity. *Retina* 2008;28(3 Suppl):S65-8.
 15. Sami DA. Conjunctival incisions for strabismus surgery: A comparison of techniques. *Tech Ophthalmol* 2007;5:125-9.
 16. Prakash P, Sihota R, Menon VM. Paralimbal conjunctival incision in squint surgery. *Indian J Ophthalmol* 1987;35:211-3.
 17. Mojon DS. Minimally invasive strabismus surgery. *Expert Rev Ophthalmol* 2010;5:811-20.
 18. Sharma R, Amitava AK, Bani SA. Minimally invasive strabismus surgery versus paralimbal approach: A randomized, parallel design study is minimally invasive strabismus surgery worth the effort? *Indian J Ophthalmol* 2014;62:508-11.
 19. Mojon DS. Comparison of a new, minimally invasive strabismus surgery technique with the usual limbal approach for rectus muscle recession and plication. *Br J Ophthalmol* 2007;91:76-82.
 20. Merino Sanz P, Gómez de Liaño Sánchez P, Domínguez IB. Minimally invasive strabismus surgery (MISS) compared with the fornix approach in pediatric horizontal strabismus surgery. *Strabismus* 2015;23:159-63.
 21. Badawi NM. Minimally invasive strabismus surgery versus fornix-based incision technique. *Delta J Ophthalmol* 2018;19:153-8.