Surgical Technique

Two-mm chord manual small-incision cataract surgery with phacofracture: A brief exposition of the surgical technique

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We describe a surgical technique for manual small-incision cataract extraction with 2-mm chord incision with phacofracture. The authors describe a curvilinear 2-mm chord incision 1.5 mm behind the limbus and antiparallel to the limbus with back cuts of variable length; 1.5 mm for foldable lenses and 2.5–3 mm for the rigid nonfoldable lenses. Continuous curvilinear capsulorhexis with a 26-G bent needle cystitome (or Utrata forceps) is followed by cortical cleaving hydrodissection and cartwheeling of the nucleus into the anterior chamber. A specially designed Sahu modified vectis (SMV) and a flattened visco cannula are used for the phacofracture. The heminuclei are removed along their longitudinal axis and direct implantation of the pseudophakos. Surgically induced astigmatism was found to be a mean change in astigmatism of 0.14 DCyl when the axis was ignored. Corneal endothelial counts were not vastly different from the routine manual small-incision and phacoemulsification at 3 months of follow-up. The technique used here by the surgeon for cataracts of any C (1–5) or any P (1–5) to grade NC4 NO4 as graded by the LOCS III. Case selection is of paramount importance. Two-millimeter chord MSICS with phacofracture can deliver low astigmatism and good visual recovery in cataract surgery.

Key words: 2-mm incision, astigmatism, chord incision, manual small-incision cataract surgery, phacofracture

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Cataract extraction is one of the most common surgeries performed across the world today.[1] Manual small-incision cataract surgery (MSICS) is one of the alternatives for the surgical management of cataracts. The global market for cataract surgical devices is estimated to be 7.47 billion in 2020 and is projected to reach USD 11.25 billion in 2028, growing at a compound annual growth rate (CAGR) of 5.26% from 2021 to 2028.[2] The credit for the scleral incision is given to Robert Kratz in 1980.[3]

The classical teaching for self-sealing MSICS incision described an external incision shape that can stretch, which is connected to a larger internal incision through a tunnel, which is running through the sclera and the length of this tunnel should be such that it imparts the incision a square geometry. In practice, however, that is not always the case and the length of the tunnel is not equal to the chord width of the incision. This incision is triplanar with side pockets on either side. Phacofracture permitted the incision to be decreased in size. Many methods of phacofracture are available, which include the use of two instruments or, especially designed snare. Phacofracture was first described by Kansas in the 1980s.[4]

The authors describe a surgical technique that permits manual small-incision surgery to be carried out through a curvilinear 2-mm incision, 1.5 mm behind the limbus, which is antiparallel to the limbus and has a varying length of back cut, which can be incorporated depending upon the requirement of hardness and intraocular lens implantation. For foldable lenses, the back cut is 1.5 mm while for the rigid nonfoldable lens it is kept at 2.5–3 mm.[5]

Instruments for the surgery

The instruments for this novel MSICS tunnel construction and phacofracture are revolving axis marker, Sahu modified vectis (SMV) with a 2.8-mm hanging edge, dialler with a 1-mm tip, a single jet cannula for hydrodissection and endothelium cleaning, multijet cannula for tunnel and anterior chamber cleaning, a special flattened tip visco cannula for phacofracture, and endothelium protection and a 24-G Simcoe's cannula with an oval aspiration port with overhang as shown in Fig. 1.

Surgical technique

A fornix-based conjunctival flap is raised using conjunctival spring scissors. The episcleral tissue is meticulously cleaned and wetfield cautery is used to control the bleeding. Usually a sterile Johnson bud and gentle pressure can easily provide a clean surgical field and 2 mm is marked on the stiff axis with a stained caliper. Scleral tunnel should be initiated by means

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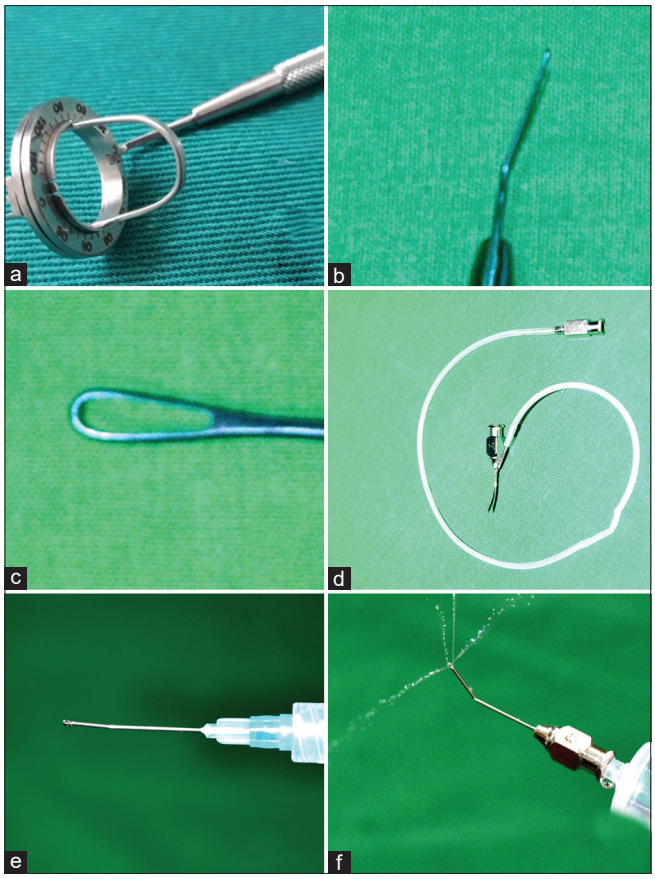

Figure 1: (a) Sahu's revolving axis marker. (b) Dialer with a 1 mm tip. (c) Sahu's Modified Vectis (SMV) with a 2.8 mm hanging edge. (d) 24-G Simcoe's cannula with an oval aspiration port. (e) Flattened tip visco cannula. (f) Multijet cannula for tunnel as well as AC cleaning

of an external incision. This external incision is curved away 1.5 mm behind the limbus. The ideal depth is about 200 μm and it can be marked by using a diamond blade or a Bard-Parker knife. A 45-degree curved-crescent-blade is used to extend these forward at a depth of about half scleral thickness into the cornea. Depth is judged by looking at the crescent through the sclera and cornea. If the crescent is seen too clearly then the depth is shallow and there is a need to go deeper. If, however, the surgeon is not able to see the crescent then the depth of the crescent is too deep and can result in perforation or premature entry. It is important to keep the orientation of the crescent bade parallel to and tangential to the sclera. The tunnel is then dissected forward with the aim of having a sloping character into the cornea. It is carried forward for 1 to 2 mm inside the clear cornea. The length of the tunnel is the distance between the external and the internal lip or the external and internal incision. The authors do not use this incision if the cataract is harder than the grade 3 LOCS3 classification or if the corneal endothelium is compromised or borderline preoperatively. Pockets are made on either side making crescent knife dissecting through the cornea into the sclera till the end of a 1.5-mm parallel scleral back cut induced from either end of a 2-mm scleral frown incision Two side pockets are then fashioned out. As a result of this now our tunnel has convex geometry outward with a truncated concavity at the top. The back cut from the concavity can be extended in either direction. The internal lip is a curved entry incision, which is made using a keratome after the side has been made using a 15-degree blade and capsulorhexis has been completed. The direction of the crescent needs to be changed when we enter the cornea from the sclera, which is distinguished easily as the cornea provides greater resistance than the sclera to the crescent blade at the limbus. In both the side pocket as well as the extension into the cornea, the crescent blade needs to be oriented to follow the curve of the eyeball. The classical teaching was that the crescent should be cut while on its way out of the incision. The crescent has to be held upward and forward because of the shape of the eyeball.

The entry of the internal lip is made by dipping the keratome tip backward. Then the internal lip is extended toward the limbus in either direction as shown in Fig. 2. It is preferable to use visco elastic in the anterior chamber through the side port to provide firmness to the eyeball before the keratome entry. The internal lip is extended in either direction from the central entry point in a curvilinear fashion.

Tunnel width is the distance between the external scleral incision and the internal corneal entry incision. The pocket tunnel dissection needs to be carried forward into the cornea beyond the vascular arcade for 1 mm into the clear cornea in front of the vascular arcade. The most important aspect of a self-sealing wound is that the keratome cuts in forward and lateral movement rather than in backward and lateral one because the valve action will be lost in case of the latter as also will be lost when the internal lip is too thick. Since the cutting takes place in the forward movement it must always be borne in mind that the keratome has to be sharp, otherwise, the detachment of the Descemet's membrane is a clear risk. Cortical cleaving hydrodissection is done with a bent cannula by tenting beneath the anterior capsule to create a freely rotating nucleus. Dispersive viscoelastic is injected into the anterior chamber and the nucleus prolapsed by nudging at the equator with a modified dialler. Again OVD is injected above and below the nucleus for endothelial protection and for pushing the iris and bag down. Sahu's modified vectis (SMV) is maneuvered under the nucleus and the flattened tip visco cannula is used to crack the nucleus between the two instruments while continuously injecting OVD taking small bites at a time as shown in Fig. 3. SMV design prevents the nucleus from slipping away. The viscocannula gently pushes one heminucleus away. The heminucleus is brought out of the tunnel along the longitudinal axis.

The author uses a special instrument to stabilize the globe and prefers not to use any forceps on the tunnel flaps. It is very important to observe the depth of the crescent in the sclerocorneal tunnel.

The first hemi-nucleus can be brought out with the sandwich technique using the vectis and the visco cannula in posterior and anterior positions, respectively. Viscoelastic should be liberally used as shown in the video. The second hemi-nucleus can then be removed using the vectis or the sandwich technique. Cortical cleanup is done using a Simcoe cannula.[6] Foldable intraocular lenses can be implanted through this incision. Parallel back cuts are 1.5 mm in 3 mm for foldable and nonfoldable lenses, respectively. The lens can be implanted directly. Implantation is done in the bag and the lens is dialed into position if required. Intracameral moxifloxacin is used before closing the incision and checking the wound integrity and intraocular pressure.

The authors do not prefer to use this for hard cataracts. The technique is used for cataracts of any C (1–5) or any P (1–5) to grade NC4 NO4 as graded by the LOCS III.[7] In case, it is realized on the table that the cataract is harder than what was assessed preoperatively then the option of extending the

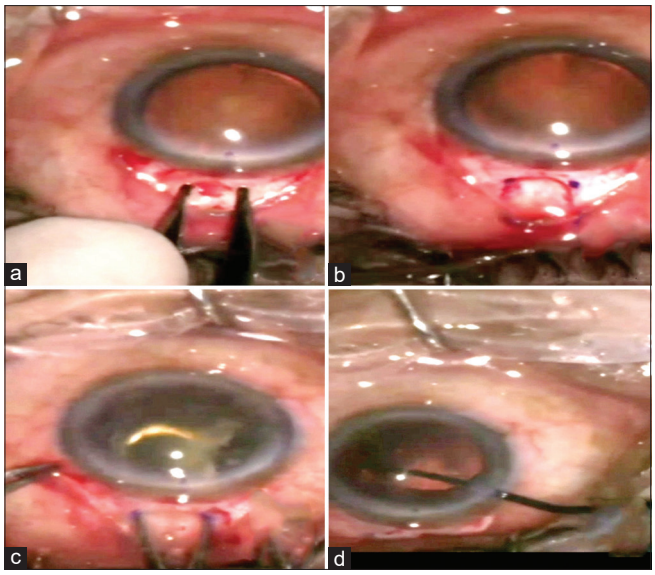

Figure 2: Legend of the Surgical Collage, (a) Marking 2-mm chord. (b) Curved incision antiparallel to limbus with 1.5 mm back cuts initiated. (c) Nucleus delivery after Phacofragmentation. (d) IOL Implantation

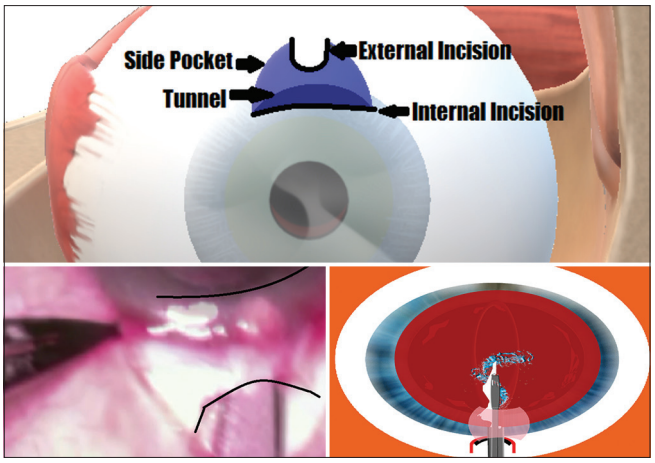

Figure 3: Anticlockwise from Left: 1. Schematic Representation of the Tunnel. 2. Incisions marked in black –External and Internal. 3. Schematic to Understand Phacofracture- Flattenned Visco Cannula with Sahu's Modified Vectis with continuous viscoinjection to push away tissues and avoid endothelial damage

incision on either side is available. There is a learning curve involved in using this technique. However, most surgeons who are routinely performing manual small-incision cataract surgery should be able to transition without hiccups. The authors, however, prefer to advocate the use of a simulator for perfecting the technique.

Surgically induced astigmatism was found to be mean change in astigmatism of 0.14 DCyl when the axis was ignored.[8] The mean astigmatism reported in classical manual small-incision cataract surgery ranges from 0.7 Dioptre (D),[9] 1.2 D[10] to 1 D[11] at 6 weeks. Lower astigmatism was reported with this technique than that reported in classical manual small-incision cataract surgery.[8] Corneal endothelial counts were not vastly different from the routine manual small-incision and phacoemulsification at 3 months follow-up.[12,13]

Conclusion

In summary, our experience with the 2-mm manual small-incision cataract surgery with parallel back cuts and phacofracture is an advance over the routinely practiced standard MSICS. Some special instruments that are required have been designed specifically for this procedure. This technique has immense potential for a developing country like India. It is a promising surgery in the armamentarium of cataract surgeons whether or not they have access to phacoemulsification machines.

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Conflicts of interest

There are no conflicts of interest.

References

1. Micieli J, Arshinoff S. Cataract surgery. CMAJ 2011;183:1621.
2. Cataract Surgical Devices Market Size, Share & Growth, 2026. Fortunebusinessinsights.com. 2022. Available from: https://www.fortunebusinessinsights.com/industry-reports/cataract-surgical-devices-market-101957. [Last accessed on 2022 May 15].
3. Kratz RP, Colvard DM, Mazzocco TR, Davidson B. Clinical evaluation of the terry surgical keratometer. Am Intraocular Implant Soc J 1980;6:249-51.
4. Gerald TKJ. The nucleus division technique for small incision cataract extraction. In: George WR, Aziz MY, Axis MD, editors. Alternative Small Incision Technique. Thorofare, N.J. Slack Inc.; 1990. p. 163-95.
5. Sahu A. Topography Guided 2 mm SICS. AIOC 2019. Indore: Editor Proceedings All India Ophthalmology Society; 2022. Available from: https://www.youtube.com/watch?v=3MUvxD0gyak. [Last accessed on 2022 Jan 13].
6. Ruit S, Tabin G, Chang DF, Bajracharya L, Kline DC, Richheimer W, *et al*. A prospective randomized clinical trial of phacoemulsification vs manual sutureless small incision extracapsular cataract surgery in Nepal. Am J Ophthalmol 2007;143:32-8.
7. Chylack L. The lens opacities classification system III. Arch Ophthalmol 1993;111:831-6.
8. Sahu A, Bali J, Sahu C, Mishra D, Heda A, Deori N. Early postoperative astigmatism in 2-mm manual small incision cataract surgery with phacofracture. Indian J Ophthalmol 2022;70:1997-2001.
9. Ruit S, Tabin GC, Nissman SA, Paudyal G, Gurung R. Low-cost high-volume extracapsular cataract extraction with posterior chamber intraocular lens implantation in Nepal. Ophthalmology 1999;106:1887-92.
10. Gogate PM, Kulkarni SR, Krishnaiah S, Deshpande RD, Shilpa A, Joshi SA, *et al*. Safety and efficacy of phacoemulsification compared with manual small- incision cataract surgery by a randomized controlled clinical trial: Six-week results. Ophthalmology 2005;112:869-74.
11. Muralikrishnan R, Venkatesh R, Manohar BB, Venkatesh PN. A comparison of the effectiveness and cost effectiveness of three different methods of cataract extraction in relation to the magnitude of post-operative astigmatism. Asia Pacific J 2003;15:33-40.
12. Sahu A. Magic of SICS-2. 75th Platinum Conference All India Ophthalmology Society Annual Conference AIOC-2017. Jaipur India: All India Ophthalmology Society; 2017. Available from: https://proceedings.aios.org/2017/the-magic-of-sics-2/. [Last accessed on 2022 Aug 31].
13. Sahu A. Topography Guided 2 mm SICS. AIOC 2019. Indore: Editor Proceedings All India Ophthalmology Society; 2022. Available from: https://www.youtube.com/watch?v=3MUvxD0gyak. [Last accessed on 2022 Aug 31].