American Journal of Ophthalmology Case Reports 26 (2022) 101442

Contents lists available at ScienceDirect

American Journal of Ophthalmology Case Reports

journal homepage: www.ajocasereports.com/

Portable femtosecond laser assisted cataract surgery in a child with bilateral ectopia lentis with microspherophakia

Nidhi Kalra [a], Rinky Agarwal [a], Tushar Agarwal [a], Rajesh Sinha [a,*]

[a] Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi, India

ARTICLE INFO

Keywords:
Microspherophakia
Ectopia lentis
Femtosecond laser
Capsulotomy
Pediatric cataract

ABSTRACT

Purpose: The purpose of this case report is to describe the utility of portable femtosecond laser platform in a child with bilateral isolated microspherophakia and ectopia lentis performed under general anesthesia.
Observation: An appropriately sized and well centered capsulotomy with well centered PCIOL could be achieved in both eyes of the patient.
Conclusion & Importance: The advent of mobile femtosecond laser assisted cataract surgery might prove a useful and convenient platform for surgeries in pediatric patients with subluxated cataracts even under general anesthesia. It may circumvent the need for an additional laser suite and reduce surgical time by eliminating the need for patient movement.

1. Introduction

Microspherophakia is a bilateral condition associated with smaller equatorial diameter and increased anteroposterior diameter of the crystalline lens, making the whole lens visible on full pupillary dilation. It is an autosomal recessive disorder which may occur in isolation or as part of various systemic syndromes.[1] It usually presents in early childhood, thereby increasing the risk of amblyopia. Surgical intervention is indicated for high myopia or astigmatism not amenable to correction by refraction, cataract, glaucoma or presence of significant subluxation or dislocation of the lens. Earlier described techniques include the intracapsular extraction and pars plana techniques of removing the lens.[2] However, the currently accepted treatment approach is either intralenticular bimanual lens aspiration or lens aspiration with preservation of the capsular bag and supporting the bag with endocapsular ring depending on the amount of subluxation.[3]

Creation of a continuous curvilinear capsulorhexis (CCC) is the most crucial step to enable the placement of capsular fixation devices and a posterior chamber intraocular lens (PCIOL). Factors hampering the creation of a manual capsulorhexis in these eyes include shallow or deep anterior chamber, lens tilt, presence of vitreous and inadvertent movement of the lens. The inherent elasticity of the lens capsule in pediatric patients may pose further challenges during manual capsulorhexis even in experienced hands. Use of femtosecond laser has been described as an efficacious tool in creating a capsulotomy and softening the nucleus in patients with compromised zonules.[4]One study showed that 70% of cases of subluxated cataracts can be managed with femtosecond laser to perform the capsulotomy and nuclear fragmentation, with preservation of the capsular bag in 91.5% cases.[5] However, it is limited by the need to transfer patients from laser suite to the operating room. It is believed that the newly introduced portable femtosecond laser assisted cataract surgery (FLACS) platform might aid in overcoming this restriction in pediatric patients.[6] However, we describe for the first time the safety and efficacy of this system in management of a child with ectopia lentis with microspherophakia under general anesthesia.

2. Case report

A 13 years old boy presented with four years history of progressive decrease of vision in both eyes. Corrected distance visual acuity (CDVA) was 20/40 Right eye (−8.0/-3.0 × 160°) and 20/25 Left eye (−11.0/-2.0 × 20°). On dilation, both eyes had small spherical crystalline lenses with nasal subluxation.

Fundus examination and Intraocular pressure (IOP) were within normal limits in both eyes. Axial length was 20.76mm RE and 20.74mm LE. He was diagnosed as microspherophakia with ectopia lentis both eyes and planned for lens aspiration followed by implantation of capsular tension ring (CTR) and posterior chamber intraocular lens (PCIOL) in both eyes, right followed by left. Systemic co-morbidities were ruled out and written informed consent was taken from the

* Corresponding author. FRCS, Cornea, Lens & Refractive Surgery Services, R P Centre, AIIMS, New Delhi, 110029, India.
E-mail address: sinharaj1@gmail.com (R. Sinha).

https://doi.org/10.1016/j.ajoc.2022.101442
Received 10 December 2020; Received in revised form 22 January 2022; Accepted 16 February 2022
Available online 2 March 2022

parents. Surgery was performed under general anesthesia. A mobile femtosecond laser (LensAR, Orlando, FL) was used for the surgery.

Wireless integration with Cassini corneal shape analyzer was performed prior to the surgery. The parameters used for capsulotomy were energy 7μJ, depth 0.85mm and diameter 4.5mm. The laser patient interface (LPI) was centered and positioned using the limbus as a reference point. Vacuum was activated and the aperture was filled with balanced salt solution (BSS). The docking was completed. Three dimensional images were obtained and centration and size of capsulotomy were rechecked. Laser was activated, creating an anterior capsular opening well centered on the subluxated lens capsule and not the pupil (Fig. 1). The time duration of docking to completion of laser was within 2–3 minutes. The machine was moved away and the surgical area was made sterile with 5% betadine for 2 minutes followed by thorough wash of the ocular surface. Two side port incisions were created manually for bimanual irrigation aspiration of the lens. After completing lens aspiration and filling the empty capsular bag with cohesive viscoelastic, a capsular tension ring (CTR) (Model type 4 diameter 11/13mm) was implanted within the bag. This was followed by PCIOL (Acrysof IQ SN60WF +29.0D) implantation in the bag. Similar steps were repeated in the left eye at an interval of three days. Apart from creating a round capsulotomy, mobile-femtosecond laser assisted lens fragmentation and softening could be attained in both eyes. Astigmatism treatment was not planned for this patient as the astigmatism was primarily lenticular and not corneal. Moreover, the outcomes of astigmatism correction in these eyes can be unpredictable.

Postoperatively, the patient was put on moxifloxacin hydrochloride 0.5% TID, prednisolone phosphate 1% QID and tropicamide sulphate 1% eye drops TID.

The uncorrected visual acuity was 20/20 in RE and 20/25 LE at one week following surgery with well centered PCIOLs and an IOP of 16 in both eyes. At one-month follow-up the uncorrected visual acuity and IOP remained unchanged and the IOLs were well centered (Fig. 2).

3. Discussion

Preservation of the capsular bag is very essential for successful placement of PCIOL. For a subluxated cataract, it is extremely important to maintain centration of the capsular bag by placement of CTR or capsule fixation devices so that the centre of the IOL coincides with the visual axis thereby providing optimal visual outcome. The Femtosecond laser provides an advantage over manual CCC by exerting minimal or no traction on the compromised zonules.[5] The use of FLACS has been previously described for creation of predictable and centered capsulotomy

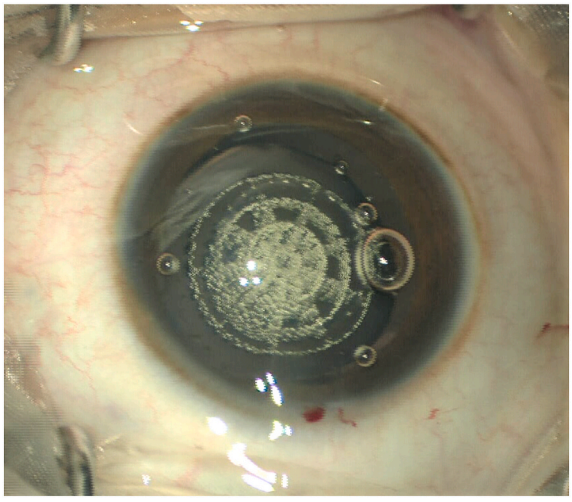

Fig. 1. Well centered capsulotomy and nuclear fragmentation with femtosecond laser.

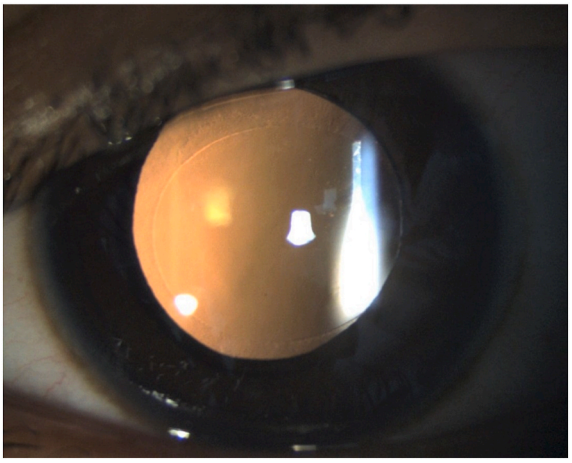

Fig. 2. Postoperative picture of the patient showing a well centered capsulotomy and PCIOL.

in children.[6,7] Besides subluxated cataracts, FLACS has further been utilized in several complex cases such as traumatic cataracts, lens capsule damage, intumescent cataracts, posterior polar cataracts, anterior capsular anomalies like Alport's syndrome, brunescent cataracts, eyes with prior refractive surgeries and lower endothelial cell counts.[8] Schultz T and coworkers employed the FLACS system (Catalys Precision Laser System; OptiMedica, Sunnyvale, CA) to create a precisely sized capsulotomy under general anesthesia in a 10 years old boy with Marfans syndrome with ectopia lentis.[9] However, the laser system had to be installed in the operating room in their case. This required monitoring of temperature settings and was elaborate and time consuming. Dick and co-workers created both anterior and posterior capsulotomy with femtosecond laser in children and provided the Bochum formula to minimize the deviation between the targeted and created diameter of the CCC.[10]

The LensAR laser system received FDA approval in 2015. It is capable of wireless integration with preoperative devices like the Cassini Corneal Shape Analyzer (Cassini, Hague, Netherlands), OPD Scan-III (Nidek, Aichi, Japan), Aladdin (Topcon Corporation, Tokyo, Japan) and both Pentacam®HR and AXL (OCULUS Optikgeräte GmbH, Wetzlar, Germany). Enabling wireless data transfer improves the procedure flow and reduces the chances of manual error by data entry. However, we transferred the data with the Cassini as it was the first device to be integrated with LensAR and has consistently given optimal results in the past.

Since it is based upon a liquid interface, there is minimal corneal distortion during docking. It consists of a rotating camera that takes images from up to eight positions from two angles of the eye's optical axis, thereby providing a three-dimensional image.[13] The mobile femtosecond laser system can be used in any operating room without affecting the flow of cases in the theatre. It is not sensitive to environmental fluctuations. The surgery can be performed on the conventional table without the need for patient movement.[11]

In our case, this modality allowed successful attainment of appropriately sized and centered anterior capsulotomy without causing additional stress on the already stretched zonules. Precise sizing and centration of capsulotomy according to the size and position of subluxated lens allowed successful placement of CTR and perfect centration of PCIOL optic. Lack of any loose edges prevented inadvertent extension of anterior capsulotomy. There was no significant additional increase in the total surgical time and anesthesia time. Posterior capsulotomy was not needed as the child was 13 years old.

Capsulotomy created by femtosecond lasers can have micro tears[12] and chances for this were reduced by using low energy settings and lower spot separation. Secondly, the swiveling motion of the device

while capturing the three-dimensional images was obstructed by the presence of the laryngeal mask airway. This was circumvented by the anesthesia team by placing the airway laterally while operating the second eye.

4. Conclusion

Mobile FLACS might prove a useful and convenient platform for surgeries in pediatric patients with ectopia lentis and microspherophakia even under general anesthesia. It may circumvent the need for an additional laser suite and reduce surgical time by eliminating the need for patient movement. Further large long-term comparative studies are needed to validate its use in complicated pediatric cataract surgeries.

Patient consent

Written informed consent was taken from the father to obtain and publish images and information.

Author contributions

Nidhi Kalra: Conceptualization, Methodology, Writing original draft. Rinky Agarwal: Validation, Investigation, Writing review and editing. Tushar Agarwal: Supervision, Writing review and editing. Rajesh Sinha: Conceptualization, Methodology, Visualization, Investigation, Writing review and editing.

Conflicts of interest

No conflict of interest exists.

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

Funding

No funding was received for this work.

Intellectual property

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

Research ethics

We further confirm that any aspect of the work covered in this manuscript that has involved human patients has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

Authorship

All listed authors meet the ICMJE criteria.

We attest that all authors contributed significantly to the creation of this manuscript, each having fulfilled criteria as established by the ICMJE.

We confirm that the manuscript has been read and approved by all named authors.

We confirm that the order of authors listed in the manuscript has been approved by all named authors.

Contact with the editorial office

This author submitted this manuscript using his/her account in EVISE.

We understand that this Corresponding Author is the sole contact for the Editorial process (including EVISE and direct communications with the office). He/she is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs.

We confirm that the email address shown below is accessible by the Corresponding Author, is the address to which Corresponding Author's EVISE account is linked, and has been configured to accept email from the editorial office of American Journal of Ophthalmology Case Reports:

Declaration of competing interest

The authors have no financial disclosures.

All authors attest that they meet the current ICMJE criteria for Authorship.

Acknowledgements

No funding or grant support.

References

1. Chan RTY, Collin HB. *Microspherophakia. Clinical and Experimental Optometry*. 2002; 85(5):294–299.
2. Wu-Chen WY, Letson RD, Summers CG. Functional and structural outcomes following lensectomy for ectopia lentis. *J AAPOS*. 2005;9:353–357.
3. Sinha R, Sharma N, Vajpayee RB. Intralenticular bimanual irrigation: aspiration for subluxated lens in Marfan's syndrome. *J Cataract Refract Surg*. 2005;31:1283–1286.
4. Dick HB, Schelenz D, Schultz T. Femtosecond laser–assisted pediatric cataract surgery: Bochum formula. *J Cataract Refract Surg*. 2015;41(4):821–826.
5. Chee SP, Wong MHY, Jap A. Management of severely subluxated cataracts using femtosecond laser–assisted cataract surgery. *Am J Ophthalmol*. 2017;173:7–15.
6. Corredor-Ortega C, Gonzalez-Salinas R, Montero MJ, et al. Femtosecond laser-assisted cataract surgery in pediatric patients. *J AAPOS*. 2018;22(2):148–149.
7. Dick HB, Schultz T. Femtosecond laser-assisted cataract surgery in infants. *J Cataract Refract Surg*. 2013;39(5):665–668.
8. Kanclerz P, Alio JL. The benefits and drawbacks of femtosecond laser-assisted cataract surgery. *Eur J Ophthalmol*. 2021;31(3):1021–1030.
9. Schultz T, Ezeanosike E, Dick HB. Femtosecond laser-assisted cataract surgery in pediatric Marfan syndrome. *J Refract Surg*. 2013;29(9):650–652.
10. Dick HB, Schelenz D, Schultz T. Femtosecond laser-assisted pediatric cataract surgery: Bochum formula. *J Cataract Refract Surg*. 2015;41(4):821–826.
11. Fung SSM, Brookes J, Wilkins MR. AdamsGGW. Mobile femtosecond laser platform for pediatric cataract surgery. *Eur J Ophthalmol*. 2018;28(2):246–250.
12. Kohnen T, Klaproth OK, Ostovic M, Hengerer FH, Mayer WJ. Morphological changes in the edge structures following femtosecond laser capsulotomy with varied patient interfaces and different energy settings. *Graefes Arch Clin Exp Ophthalmol*. 2014;252 (2):293–298.
13. Packer M, Klyce SD, Smith C. The LENSAR® Laser System–fs 3D for femtosecond cataract surgery. *Eur Ophthalmic Rev*. 2014;8:93–98.