Effects of Artisan aphakic intraocular lens on central corneal thickness and intraocular pressure in pediatric eyes with crystalline subluxated lenses

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Purpose: To study effects of Artisan iris fixated intraocular lens (IOL) on central corneal thickness (CCT) and intraocular pressure (IOP) in pediatric eyes with crystalline subluxated lenses.

Materials and Methods: The study included 17 eyes undergoing Artisan aphakic IOL implantation after lensectomy for subluxated crystalline lenses. CCT and IOP measurements were recorded pre-operatively and post-operatively taking the mean of 4 post-operative visits. Patients were divided into Group A (n = 8) including patients with lensectomy and iris fixation of Artisan IOL as a primary procedure and Group B (n = 9) including patients in which lensectomy was carried out as a primary surgery and Artisan IOL fixation as a secondary procedure.

Results: Children ranged in age from 08 years to 16 years, mean 11.59 ± 2.96 years. Follow-up period ranged from 7 months to 16 months, mean 11.24 months ± 4.27. Mean pre-operative and post-operative IOP in Group A was 14.88 ± 2.80 and 14.16 ± 0.59 respectively (P = 0.528). In Group B it was 12.44 ± 2.79 and 14.44 ± 1.15 respectively (P = 0.080). Mean pre-operative and post-operative CCT in Group A was 529.13 ± 24.23 and 529.87 ± 17.46 respectively (P = 0.674). In Group B it was 567.33 ± 29.13 and 568.83 ± 25.69 respectively (P = 0.859).

Conclusions: Primary and secondary Artisan aphakic IOL implantation did not cause any significant changes in corneal thickness or IOP during the follow-up period.

Keywords: Artisan aphakic intraocular lens, central corneal thickness, intraocular pressure, subluxated lens

Introduction

In 1978, Jan Worst and Fechner invented Artisan iris claw lens. It was previously known as the Worst-Fechner claw lens. Artisan aphakic intraocular lens (IOL) has been largely used in adult cataract surgery. Several studies have reported the effects of Artisan aphakic IOL on corneal endothelial cell density (ECD). Sminia et al. reported central corneal thickness (CCT) in patients with aphakic Artisan IOL implant after pediatric cataract surgery. A few other articles have reported the long-term effects of Artisan or Verisyse phakic IOL implantation on CCT and ECD following IOL implantation. A study on CCT before and after congenital cataract extraction with and without IOL implantation in pediatric cataract surgery is published in literature. The present study is the first of its kind in our part of the world, which includes analysis of the CCT and intraocular pressure (IOP) of patients undergoing Artisan aphakic IOL implantation in the pediatric age group.

Materials and Methods

This prospective, consecutive study was conducted in the

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Zafar, et al.: Intraocular pressure and corneal thickness changes with Artisan intraocular lens

Department of Pediatric Ophthalmology and Strabismus from December 2010 to April 2012. The study was approved by the Institutional Review Board. Informed consent was taken from the patients and their guardians. Seventeen children of 10 children were implanted with Artisan aphakic iris fixated IOL in aphakic eyes as a primary procedure or as a secondary procedure following lensectomy of subluxated crystalline lens. The post-operative follow-up period ranged between 7 months and 16 months. Bio-data, history, and examination findings of these patients were recorded. A detailed ophthalmological examination was carried out by a pediatric ophthalmologist. Biometry was performed using hand held touch probe A scan. CCT, IOP with an applanation tonometer and dilated funduscopy in office was noted on each follow-up. The CCT was recorded with ultrasonic pachymeter (Pac Scan 300p SONOMED). The patients were divided into two groups. Group A included patients who had lensectomy and primary Artisan iris fixated IOL implantation. Group B included patients who had lensectomy as a primary procedure and Artisan iris fixation as a secondary implant. IOP and CCT differences were compared in the two groups pre-operatively and mean CCT and IOP of four follow-up visits post-operatively.

Eyes having subluxated lenses due to axial myopia or buphthalmos as a result of glaucoma were excluded from the study. All patients underwent general anesthesia after thorough in office examination and consultation by the anesthe ISA team. We performed lensectomy and anterior vitrectomy. Peripheral iridectomy was performed in all eyes. Artisan (Ophtec, Groningen, the Netherlands) aphakic IOL was implanted through the standard insertion and enclavation technique described by the company. Intracameral moxifloxacin hydrochloride 0.5% (Vigamox, Alcon) and dexamethasone 0.4 mg were given at the end of the procedure. Topical antibiotic and steroid combination was given post-operatively. Descriptive analysis of the data was performed on SPSS software. Non-parametric Wilcoxon test was applied to compare the pre-operative and post-operative IOP and CCT.

Results

Seventeen eyes of 10 children with subluxated lenses were implanted Artisan aphakic iris fixated IOL. Seven children were female and 3 were male. Children ranged in age from 08 years to 16 years (mean 11.59 ± 2.96 years). Follow-up period ranged from 7 months to 16 months (mean 11.24 ± 4.27). Table 1 shows the pre-operative and post-operative IOP and CCT in 17 eyes included in the study. Mean pre-operative IOP of all eyes was 13.59 ± 2.98 (range 08-19 mmHg), compared to mean post-operative IOP ranging from 12 to 16 with a mean of 14.31 mmHg ± 0.916 (P = 0.351). Pre-operative CCT ranged from 491 micron to 613 micron (mean 549.35 ± 32.68) compared to post-operative CCT ranging from 502 micron to 608 micron (mean 550.50 ± 29.418) with P value of 0.906 using the non-parametric Wilcoxon test.

Table 2 shows the mean and P value of pre- and post-operative IOP and CCT of the two groups in our study. Raised IOP of 24 mmHg was recorded in one eye of Group B (eye no 10) that responded well to the topical beta blocker. The IOP was monitored and remained within normal limits even after discontinuing topical anti glaucoma drops. Complications like glaucoma, corneal decompensation or bullous keratopathy were not seen in this study. One eye (no 6) developed endophthalmitis 1 month after surgery, affecting the IOP (6 mmHg) and CCT (600 µ) of the operated eye on the last follow-up at 11 months.

Discussion

Several surgical techniques have been used to manage ectopia lentis in children such as anterior chamber angle supported IOL implantation following lensectomy, scleral fixation of posterior chamber IOL and use of intracapsular tension ring for posterior chamber IOL implantation post lensectomy and anterior vitrectomy. Each procedure has its own merits and demerits. We used Artisan aphakic IOL implant in selected cases to facilitate and accommodate more cases amongst the large number of patients with subluxated lenses. This procedure involves lesser surgical time and lesser manipulation of ocular tissues as compared to other surgical options. Since, the study is the first of its kind at our center we compared 2 different surgical approaches, in order to make it clear if two-staged surgery can be as safe as a one-step surgery, in case one is not able to implant the iris fixated lens in a single surgery. The authors hope to have a clear idea whether the patients previously rendered aphakic (not included in the present study) can be offered the option of iris fixated intra ocular lens. The pre-operative spherical equivalent (SE) data includes the refractive status before aphakic Artisan iris fixated lenses implant but after the lensectomy hence, the mean of + 12.22 D in Group B, compared to the myopic SE in Group A. This however, does not affect the comparison of the 2 groups as pre-operative corneal thickness and IOP are given from the start of the study before any surgery was attempted in both the groups.

In the present study, we focused on the effect of the Artisan aphakic IOL on CCT and IOP. ECD of these eyes is being monitored for long-term effects in another study. This CCT has been shown to increase after cataract surgery in children. This has been attributed to endothelial cell damage at the time of surgery due to mechanical stress. This increase in CCT was less in pseudophakic eyes as compared to aphakic eyes in a study by Faramarzi et al. They found that the mechanical stress during surgery was less probable because theoretically endothelial cell trauma would be greater while implanting intra ocular lens as compared to leaving the eye aphakic. A study by Pirouzian and Ip showed that CCT remained stable for 36 months follow-up period after Verisyse phakic IOL implantation. In our study, the eyes in Group A after a single surgery as well as eyes in Group B with 2 surgical procedures did not have statistically significant changes in the pre- and post-operative CCT and IOP [Table 2]. A study proposed that surgical trauma due to manipulation or irrigation solutions or post-operative inflammation affect post-operative CCT. In our study, these factors seem to have no impact on CCT. The present study on Artisan iris fixated IOL implantation
Table 1: Pre-operative and post-operative IOP and CCT of 17 eyes

| Eye Laterality | Pre-operative IOP (mmHg) | Mean IOP (mmHg) of 4 follow-up visits | Pre-operative CCT (microns) | CCT (microns) | Mean CCT (microns) |
|---------------|--------------------------|----------------------------------------|----------------------------|----------------|------------------|
|              | Age (years)              |                                        |                            |                |                  |
| 1             | RE                       | 16                                     | 12                         | 13.33          | 592              | 574              | 583              |
| 2             | RE                       | 14                                     | 12                         | 13.33          | 583              | 609              | 593              |
| 3             | RE                       | 8                                      | 16                         | 14.00          | 546              | 555              | 583              |
| 4             | RE                       | 12                                     | 14                         | 15.33          | 532              | 548              | 550              |
| 5             | RE                       | 14                                     | 14                         | 14.00          | 572              | 559              | 556              |
| 6             | RE                       | 14                                     | 16                         | 14.67          | 505              | 600              | 548              |
| 7             | RE                       | 18                                     | 16                         | 13.33          | 531              | 520              | 530              |
| 8             | RE                       | 12                                     | 16                         | 14.67          | 547              | 541              | 535              |
| 9             | LE                       | 14                                     | 12                         | 13.33          | 571              | 567              | 573              |
| 10            | LE                       | 12                                     | 12                         | 16.67          | 613              | 622              | 604              |
| 11            | LE                       | 8                                      | 12                         | 13.33          | 575              | 508              | 502              |
| 12            | LE                       | 12                                     | 16                         | 14.00          | 552              | 541              | 552              |
| 13            | LE                       | 14                                     | 12                         | 14.67          | 522              | 551              | 529              |
| 14            | LE                       | 16                                     | 14                         | 14.67          | 541              | 539              | 527              |
| 15            | LE                       | 19                                     | 14                         | 14.67          | 556              | 558              | 554              |
| 16            | LE                       | 12                                     | 14                         | 14.00          | 510              | 514              | 511              |
| 17            | LE                       | 16                                     | 12                         | 13.33          | 491              | 511              | 501              |

RE: Right eye, LE: Left eye, CCT: Central corneal thickness, IOP: Intraocular pressure

Table 2: Pre-operative and post-operative parameters of primary versus secondary Artisan aphakic IOL implantation

| Parameters                      | Primary Artisan aphakic IOL implantation group A N=8 | Secondary aphakic IOL implantation group B N=9 |
|--------------------------------|------------------------------------------------------|---------------------------------------------|
| Follow-up (months)             | Range 7-11                                           | Range 7-16                                  |
|                                | Mean 7.50±1.41                                       | Mean 14.56±2.88                            |
| Pre-operative IOP             | 14.88±2.8                                            | 12.44±2.79                                 |
| Mean post-operative IOP       | 14.16±0.59                                           | 14.44±1.15                                 |
| P= value within*              | 0.528                                                | 0.080                                      |
| Pre-operative CCT             | 529.13±24.23                                         | 567.33±29.13                               |
| Mean post-operative CCT       | 529.87±17.46                                         | 568.83±25.69                               |
| P= value within*              | 0.674                                                | 0.859                                      |
| Pre-operative SE              | −1.75±8.24                                           | 12.44±1.81                                 |
| Mean post-operative SE        | 3.15±2.55                                            | 1.5±1.6                                   |

IOL: Intraocular lens, IOP: Intraocular pressure, CCT: Central corneal thickness, SE: Spherical equivalent, *Based on Wilcoxon test

also, did not show any statistically significant increase in CCT whether we compared the pre-operative CCT with the CCT at last follow-up (P = 0.237) or with the mean CCT of three follow-up visits (P = 0.906) using the non-parametric Wilcoxon test. Eye no 6, which developed endophthalmitis showed negative culture results of aqueous and vitreous tap was treated according to the treatment protocol for post-operative endophthalmitis of our hospital.[10] The eye became soft and showed delayed increase in CCT at 11 months of follow-up with an IOP of 6 mmHg. The readings recorded in this eye affected the mean CCT and IOP of our study, as well. Even though the difference in pre and post-operative readings of this patient’s eye varied from the rest of the eyes in our study it did not significantly affect the final results, while comparing the mean pre-operative IOP with the post-operative mean IOP of 3 follow up visits (P = 0.351) or with the last follow-up IOP (P = 0.633), post-operatively using the non-parametric Wilcoxon test. Similar statistically insignificant difference in mean pre-operative and 6 month post-operative IOP after pediatric cataract surgery within the aphakic and pseudophakic group (P = 0.58 and P = 0.74, respectively) was reported in a study.[6] The study by Faramarzi et al. shows that IOL may have a protective role against increase in CCT after surgery as he found lesser change in CCT in pseudophakic patients than aphakic patients after cataract surgery.[6] Our patients having iris fixated IOL implantation did not cause significant change in CCT after surgery. We can presume that IOL in this position also carries the unknown protective effect found in posterior chamber IOL implantation. Several studies have shown effect on endothelial cell count after Artisan aphakic implant.[1-13] Endothelial cell loss in these studies is significant, but it did not affect the corneal thickness as mentioned in a study by Sminia et al., which gives only the final reading of CCT at the last follow-up. The calculated mean CCT of their study was 545 µ±64 SD.[13] Our study with a mean CCT of 550.50 µ±29.41 recorded at the last follow-up is comparable to the above study. The other studies however did not mention the CCT or IOP effects, after implanting the aphakic Artisan IOL’s in children. Decrease in corneal ECD takes place due to cataract surgery.[14] Risk factors for reduced ECD before cataract surgery is influenced by many factors, including pre-operative IOP.[12] These studies do not provide the effects on CCT. Patients having age range of 12.7 ± 6.6 years in a study compared to 11.59 ± 2.96 years in our study showed thicker CCT after congenital cataract surgery compared to controls. Their study shows adjusted IOP for the increase in CCT.[13] This consideration is required where corneas are significantly thick.[14] Conversely minor elevations in IOP are of less concern in children with thick corneas.[30] Spearman non-parametric test did not give any significant correlation between IOP and CCT before (P = 0.589) and between mean IOP and mean CCT after surgery (P = 0.935) in our study. IOP adjustment according to CCT was not required in our study. Corneal thickness can increase as a result of impaired endothelial cell function which may result from surgical trauma at the time of cataract surgery or after that. [10,15,16] We did not find any...
Zafar, et al.: Intraocular pressure and corneal thickness changes with Artisan intraocular lens

identifiable corneal edema on clinical examination after surgery in our patients. From this preliminary study, we can conclude that the primary or secondary Artisan iris fixed IOL implantation would be safe in children as the IOP and CCT were not statistically significant during the follow-up period after surgery. However, studies with longer follow-up and larger sample size are required for long-term effects and obtaining statistically significant values for comparison.

References

1. Cleary C, Lanigan B, O’Keeffe M. Artisan iris claw lenses f 170 or the correction of aphakia in children following lensectomy for ectopia lentis. Br J Ophthalmol 2012;96:419-21.
2. Lifshitz T, Levy J, Klemperer I. Artisan aphakic intraocular lens in children with subluxated crystalline lenses. J Cataract Refract Surg 2004;30:1977-81.
3. Sminia ML, Odenthal MT, Prick LJ, Mounts MP, Volker-Dieben HJ. Long-term follow-up of the corneal endothelium after aphakic iris-fixed IOL implantation for bilateral cataract in children. J Cataract Refract Surg 2011;37:866-72.
4. Pirouzian A, Ip KC. Anterior chamber phakic intraocular lens implantation in children to treat severe anisometropic myopia and ambylophia: 3-year clinical results. J Cataract Refract Surg 2010;36:1486-93.
5. Tychsen L, Hoekel J, Ghasia F, Yoon-Huang G. Phakic intraocular lens correction of high ametropia in children with neurobehavioral disorders. J AAPOS 2008;12:282-9.
6. Faramarzi A, Javadi MA, Jabbarpour Bonyadi MH, Yaseri M. Changes in central corneal thickness after congenital cataract surgery. J Cataract Refract Surg 2010;36:2041-7.
7. Muir KW, Duncan L, Enyedi LB, Wallace DK, Freedman SF. Central corneal thickness: Congenital cataract and aphakia. Am J Ophthalmol 2007;144:502-6.
8. Lupinacci AP, da Silva Jordao ML, Massa G, Arieta CE, Costa VP. Central corneal thickness in children with congenital cataract and children with surgical aphakia: A case-control study. Br J Ophthalmol 2009;93:337-41.
9. Simon JW, O’Malley MR, Gandham SB, Ghaiy R, Zobal-Ratner J, Simmons ST. Central corneal thickness and glaucoma in aphakic and pseudophakic children. J APOS 2005;9:326-9.
10. Ishaq N. Al Shifa Endophthalmitis Study: Protocol of treatment and prognosis. Al-Shifa J Ophthalmol 2005;1:88-94.
11. Yeniad B, Corum I, Ozgun C. The effects of blunt trauma and cataract surgery on corneal endothelial cell density. Middle East Afr J Ophthalmol 2010;17:354-8.
12. Ishikawa A. Risk factors for reduced corneal endothelial cell density before cataract surgery. J Cataract Refract Surg 2002;28:1982-92.
13. Nilforushan N, Faiavarijani KG, Razeghehnejad MR, Bakhtiari P. Cataract surgery for congenital cataract: Endothelial cell characteristics, corneal thickness, and impact on intraocular pressure. J APOS 2007;11:159-61.
14. Doughty MJ, Zaman ML. Human corneal thickness and its impact on intraocular pressure measures: A review and meta-analysis approach. Surv Ophthalmol 2000;44:367-408.
15. Simon JW, Miter D, Zobal-Ratner J, Hodggets D, Belin MW. Corneal edema after pediatric cataract surgery. J APOS 1999;1:102-4.
16. Amino K, Miyahara S, Tanihara H. Corneal thickness in eyes following pars plana lensectomy for congenital cataracts. Jpn J Ophthalmol 2004;48:169-71.

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