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PROFILE OF POSTERIOR CAPSULE OPACIFICATION IN PSEUDOPHAKIC PATIENTS

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ABSTRACT

The aim of this retrospective study was to evaluate a precise profile of PCO and to explore factors that might influence rate and development of PCO with special reference to surgical technique, IOL material and duration since surgery. **Material and methods**: The study was carried out on 200 consecutive eyes of patients reporting with decreased visual acuity due to PCO, following a successful cataract surgery with PCIOL implantation done by a single surgeon. Case records of all the patients were reviewed for duration of onset of PCO since surgery, type of surgery, type of cataract, type of IOL used and associated ocular and systemic disease. Then the patients were evaluated for the type of PCO and PCO grading was done using slit lamp biomicroscope. The grading of PCO was based on amount of IOL covered by PCO and the fundal glow seen after papillary dilation. **Conclusion**: It was observed that onset of PCO was early in SICS cases as compared to Phaco and also in those cases who were implanted with hydrophilic acrylic IOLs. PCO development was least common in cortical types of cataract. Elschnig pearls type of PCO was predominately seen in our study.

KEYWORDS: Posterior capsule opacification; pseudophakia.

INTRODUCTION

Early visual rehabilitation and targeting of emmatropia using small incision and foldable intraocular lens (IOL) is main objective of modern cataract surgery, the so termed 'Refractive Cataract Surgery'.

Posterior capsule opacification remains the most common complication of extra capsular cataract surgery, causing decrease in visual acuity, impaired contrast sensitivity and glare disability.[1,2] It also has an important implication in the developing world, where it may increasingly become a significant cause of treatable blindness.[2] Central to pathogenesis of PCO is the concept that, following cataract surgery, lens epithelial cells (LECs) migrating from the equator of the capsular bag undergo myofibroblast or fibroblastic- like change (so called fibrous pseudometaplasia) behind the optic of the IOL implant. Reduction of the complication is important as Neodymium-doped yttrium aluminium garnet (Nd:YAG) laser capsulotomy, the treatment of PCO is sometimes a dangerous procedure with potential damage to IOL, vitreous, retina, and other structures. Treatment of PCO also imposes significant cost burden on poor patients.[3] The pathophysiology of PCO is multifactorial. Studies have shown that there are three main factors that influence incidence and development of PCO i.e surgical technique[4], IOL design[5-7], and IOL material.[5-7] Advances in surgical technique and improvement in IOL design have greatly reduced the incidence of PCO.

Opacification may be reduced by atraumatic surgery and thorough cortical clean up.[4] Clinical, pathological and experimental studies have shown that use of hydrodissection, continuous curvilinear capsulorrhexis (CCC) and surgical technique, 360-degree overlap of CCC and IOL optic is essential to prevent PCO because it provides an effective barrier.[8] It is important to consider the IOL optic size when evaluating PCO. IOLs with large optic size prevent PCO. Capsular-fixed, one piece all polymethmethylacrylate (PMMA) posterior chamber intraocular lens (PC-IOL) with a C- shaped loop configuration and posterior convexity of the optic are effective. PMMA loops that retain memory create symmetric, radial stretch on the posterior capsule after in-the-bag placement, leading to more complete contact between the posterior surface of the IOL optic and taut capsule. In context to IOL design, the theory that an IOL with sharp posterior optic edge prevents PCO has gained acceptance.[9,10] There are two theories of how sharp edged optics inhibit PCO formation.[8-13] One is compression theory and the other is that a sharp optic

edge induces the formation of a sharp capsular bend, which creates contact inhibition between migrating LECs.[12,13] The optic haptic junction is another important factor in preventing PCO as it diminishes the barrier effect of the square edged IOL design and gives migrating LECs access to posterior capsule.[14] The issue of whether PCO is influenced by IOL material, however, remains controversial. The studies done by Iwase et al[7], Heartly et al[5], Moin et al[15] have shown the rate of PCO significantly increasing with hydrophilic as compared to hydrophobic lenses.

The reported rates of PCO vary widely and are based on various factors, such as type of cataract, type of surgery, duration of onset of PCO since surgery, IOL material, type of PCO and associated systemic and ocular illness.

The present clinical study was designed to obtain a precise overall profile of PCO and to explore factors that might influence rate and development of PCO, with special reference to three main factors implicated in various studies i.e. the surgical technique, IOL material and duration of onset of PCO since surgery.

While assessing, the PCO was graded based on amount of IOL covered by PCO and the fundal glow seen after full dilation of pupil.

MATERIAL AND METHODS

In the present study a total of 200 consecutive pseudophakic eyes with PCO which were operated by a single surgeon in a tertiary health care hospital in North India were studied retrospectively. Case records of all the patients were reviewed for date of surgery (duration of onset of PCO since surgery), type of surgery, type of cataract, type of IOL used and associated ocular and systemic illness.

Patients with history of trauma, congenital cataract, complicated cataract, patients with no operative records, known complication during/after surgery and patients having corneal pathology, glaucoma or any other ocular diseases were excluded from the study.

All the patients were subjected to a detailed ocular examination including BCVA, refraction, tonometry, detailed slit lamp examination and a detailed fundus examination. Slit examination was done with both undilated and dilated pupil. Parameters like any corneal pathology, AC cells, flare, position of IOL (in the bag or in the sulcus) was noted, the extent and type of PCO was noted and grading of PCO was done.

Grading of PCO

PCO was assessed by slit lamp examination after pupil dilatation and was graded as below:

Elschnig pearls type of PCO

Grade I (mild)- covering less than 1/3rd area of IOL optic
Grade II (moderate)- covering more than 1/3rd and less than 2/3rd area of IOL optic
Grade III (severe) – covering more than 2/3rd area of IOL optic

Fibrous - type of PCO was graded as follows with retroillumination on slit lamp biomicroscope:
Grade I (mild) - a uniform faint fundal glow present in the area of IOL optic
Grade II (moderate)- a patchy fundal glow present in the area of IOL optic
Grade III (severe)- fundal glow not visible in the area of IOL optic

After the assessment of PCO, willing patients were treated by Nd:YAG laser capsulotomy.

Data collection

After reviewing the discharge card and thorough clinical workup, data was collected and recorded regarding type of cataract (cortical, nuclear, posterior subcapsular cataract), type of surgery (phacoemulcification/SICS), duration of onset of PCO, type of PC-IOL implanted (PMMA, acrylic hydrophilic, acrylic hydrophobic lenses), presence of preoperative or intraoperative plaque.

Statistical analysis

At the end of study the data was collected and analysed statistically. Quantitative data was presented as mean and standard deviation and was analysed by Independent sample t-test and analysis of variance (ANOVA). Qualitative variables were presented as simple proportions, percentages and analyzed using Chi- square test, Chi- square goodness of fit, and Z test for proportion.

RESULTS

Out of 200 eyes, 4 eyes (2%) belonged to patients who were in the age group of 31-40 years, 14 (7%) to patients in age group between 41-50 years, 78(39%) patients in age group between 51-60 years, 66 (33%) patients in age group between 61-70 years and 38 (19%) to patients in the age group >70 years .Out of total 200 eyes of patients selected, 103 (51.5%) eyes were of male patients while remaining 97 (48.5%) eyes were of female patients.

140(70%) eyes of patients had undergone phacoemulsification cataract surgery while 60(30%) SICS. The mean age of patients in phaco group was 59.77 ± 9.12 years, and in SICS group it was 65.4 ±7.77 years in comparison to 61.46 ±9.06 years for all patients (Table 1).

In our study, 8 (4%) eyes of patients presented within 1 year of surgery, while 100 (50%) eyes presented between 1.1 to 2 years of surgery,76 (38%) eyes presented between 2.1 to 3 years of surgery and 13 (6.5%) eyes presented between 3.1 to 4 years of surgery (Table 2).

Thus almost 98% of mean duration of onset of PCO since surgery in phaco group was 2.63 ± 0.726 years and in SICS group was 2.26 ± 0.723years. (Table 3).

Based on the type of IOL material used, 41(20.5%) eyes of patients had PMMA IOL, while 124(62%) eyes had acrylic hydrophilic IOL, 35(17.5%) eyes had acrylic hydrophobic IOL (Table 4).

Mean duration of onset of PCO since surgery was highest in acrylic hydrophobic type of IOLs and lowest in PMMA type of IOLs (with mean duration of 2.97±0.707 years and 2.24±0.799 years respectively).There was significant difference when the hydrophobic lens material was compared to hydrophilic lens material (Table 5).

In phacoemulsification group no PMMA lens was used, 106 acrylic hydrophilic and 34 acrylic hydrophobic lenses were used. In SICS group, PMMA lenses were used in 41 cases, while 18 acrylic hydrophilic and one acrylic hydrophobic lens were used (Table 6).

Type of PCO

In our study, presence of elschnig pearls was noted in 136 (68%) eyes of patients, fibrous in 41 (20.5%) and mixed (elschnig pearls as well as fibrous) in 23(11.5%) eyes of patients (Table 7).

The mean duration of onset of different type of PCO since surgery was studied and it was found that mean duration in Elschnig pearls group was 2.53±0.69 years, while in fibrous group was 2.46±0.86 years and in mixed (elschnig pearls as well as fibrous) group was 2.52±0.79 years (Table 8).

Different types of PCO were studied with respect to different types of IOL material. It was observed that Elschnig pearls type of PCO was seen in 16 eyes of patients having PMMA, 31 acrylic hydrophobic and 89 acrylic hydrophilic. Fibrous type of PCO was seen in 19 eyes of patients having PMMA, 1 acrylic hydrophobic, and 21 acrylic hydrophilic. Mixed (elschnig pearls as well as fibrous) type of PCO seen in 6 eyes of patients having PMMA IOLs, in 3 cases of acrylic hydrophobic, and 14 cases of acrylic hydrophilic IOL (Table 9).

In our study 36 (18%) of eyes of patients had cortical cataract while 82 (41%) had nuclear cataract and 82 (41%) had posterior subcapsular cataract.

Table 1: Mean age of patients in SICS and phacoemulsification group.

Group (based on)	Mean age ± SD	p-value*
Phacoemulsification group	59.77 ± 9.12	**<0.01**
SICS group	65.4 ±7.77	
Total	61.46 ±9.06	

Independent sample t-test

Table 2: Distribution Of Eyes Of Patient With Respect To Duration Of Onset Of Pco Since Surgery.

Duration(in years)	Number of eyes	%
<1	8	4
1.1-2.0	100	50
2.1-3.0	76	38
3.1-4.0	13	6.5
>4	3	1.5
Total	200	100

Chi square test, p value- <0.01

Table 3: Distribution of eyes of patients with respect with mean duration of onset of PCO since surgery in both (Phacoemulsification & SICS) groups.

Group (based on)	Mean duration± SD	p-value*
Phacoemulsification group	2.63 ± 0.726	**<0.01**
SICS group	2.26 ± 0.723	
Total	2.52 ± 0.743	

Independent sample t-test

Table 4: Distribution of eyes of patients according to type of of IOL material.

Type of of IOL material	Number of eyes	%
PMMA	41	20.5
Acrylic Hydrophilic (A)	124	62
Acrylic Hydrophobic (B)	35	17.5
TOTAL	200	100

Table 5: Mean duration of onset of PCO since surgery among different IOL material.

Type of IOL	Mean duration± SD (in years)	p-value*
Acrylic Hydrophilic	2.48±0.680	A vs B, p-0.001
Acrylic Hydrophobic	2.97±0.707	B vs C, p- <0.01
PMMA	2.24±0.799	C vs A, p- 0.215
TOTAL	2.52±0.743	

Analysis of variance (ANOVA)

Table 6 : Distribution of IOL material with respect to type of surgery.

Type of IOL	Type of surgery		Total
	Phacoemulsification	SICS	
PMMA	0	41(68.3%)	41(20.5%)
Acrylic Hydrophilic	106(75.7%)	18(30.0%)	124(62.0%)
Acrylic Hydrophobic	34(24.3%)	1(1.7%)	35(17.5%)
Total	140(100%)	60(100%)	200(100%)

Table 7: Distribution of eyes of patients with respect to type of PCO.

Type of PCO	No of eyes	Percentage(%)
Elschning pearls	136	68
Fibrous	41	20.5
Mixed (Elschning pearls as well as Fibrous)	23	11.5
Total	200	100

Table 8: Mean duration of onset of different type of PCO since surgery.

Type of PCO	Mean duration± SD (in years)	p-value
Elschnig pearls (A)	2.53±0.69	A vs B, p- 0.99
Fibrous (B)	2.46±0.86	B vs C, p- 0.99
Mixed (elschnig pearls as well as fibrous) (C)	2.52±0.79	C vs A, p- 0.99
Total	2.51±0.43	

ANOVA test

Table 9: Distribution of different types of PCO with respect to different type of IOL material.

	Elschnig pearls	Fibrous	Mixed (elschnig pearls as well as fibrous)	p-value
Acrylic Hydrophilic(A)	89 (71.8%)	21 (16.9%)	14 (11.3%)	A vs B, p-0.077
Acrylic Hydrophobic (B)	31 (88.6%)	1 (2.9%)	3 (8.6%)	B vs C, p- <0.01
PMMA (C)	16 (39%)	19 (46.3%)	6 (14.6%)	C vs A, p-<0.01
TOTAL	136 (68%)	41 (20.5%)	23 (11.5)	200

DISCUSSION

In our study number of male and female patients was almost equal, 51.5% eyes were of male patients while 48.5% eyes of female patients. The most common age group having PCO was between 51-60 years (39%) followed by 61-70 years (33%). Similar study by Hayashi et al[6] included 240 patients with mean age of 60.9 ±9.1 years with no statistical difference regarding age or sex of the patients. Gupta et al[16] also reported almost equal number of male and female patients (49% males and 51% female).

In contrast to our study, the studies done by Sheikh et al[20] (45.55 % males and 54.45% females), and Ando et al[21] (males 34.8%, females 65.2%) showed higher incidence of PCO in female patients.

In our study 140 (70%) eyes had undergone phacoemulsification cataract surgery and 60 (30%) had undergone SICS. The mean age of patients in SICS group was 65.4 ±7.77 years and 59.77±9.12 years in phacoemulsification group, which was statistically significant. This could be explained by the fact that generally SICS is done in patients who present late because of comparatively low socioeconomic status. Also in some cases SICS is a surgeon's choice for hard cataracts to avoid intraoperative complications. Hard cataracts are often seen in comparatively older age group patients.

Of all the eyes in our study, 54% presented within 2 years and 44.5% presented between 2-4years of surgery.

The mean duration of onset of PCO since surgery in phocoemulcification group was significantly less in SICS group (2.26±0.723 years) as compared to phacoemulcification group (2.63±0.726 years). The early onset of PCO in SICS as compared to phacoemulsification technique can be explained by the fact that the cortical cleanup is often more thorough using automated I/A in phaco as compared to manual I/A in SICS using Simcoe's cannula. Apple et al observed that thorough cortical cleanup minimizes the number of retained lens epithelial cells and cortex within the capsular bag and avoids the formation of PCO. Similar observations have been made by Fine et al.[17]

In our study, patients having cortical cataract had lower tendency of PCO development, 36(18%) as compared to nuclear cataract 82 (41%) and posterior subcapsular cataract (PSC) 82 (41%). Wainsztein et al[22] observed that senile complete cataracts (mature cataracts) had significantly lower tendency to produce PCO then other type of cataract (nuclear, incomplete cortical, and posterior subcapsular).

In our study 20.5% eyes of patients had PMMA IOL. While 62% eyes had acrylic hydrophilic IOL and 17.5% eyes had acrylic hydrophobic IOL. Development of PCO was seen early in eyes implanted with hydrophilic acrylic IOLs (mean duration of onset of PCO was 2.48±0.680 years) and PMMA IOLs (2.24±0.799 years) as compared to hydrophobic acrylic IOLs (2.97± 0.707 years). This observation is in accordance with other studies (Moin et al[15] 2009, Heatley et al[5] 2005, Hollick et al[18] 1999).

This observation in our study and other studies[5,15,18,23,24] that the acrylic hydrophobic IOLs cause lower PCO rate as compared to acrylic hydrophilic IOLs can be explained by the fact that, hydrophilic acrylic material is a more biocompatible material, and IOLs made of this material have been shown to support LECs adhesion, migration and proliferation.[14-16,25]

The higher rate of PCO seen with PMMA material can be explained by the fact that PMMA material may allow active proliferation of LECs possibly because of its hydrophilicity, and therefore may not be appropriate for use as an optic material.

Ahmed et al[26] compared the two types of acrylic hydrophobic and acrylic hydrophilic, and reported that 2% patients developed PCO in both the groups. They concluded that no statistical significant difference was observed in terms of post op visual acuity and PCO rate. Similar observations were made by Antony et al[27] (they reported 3.5% incidence of PCO after 3 years in both groups), Spratt et al[28] reported an incidence of 1.8% at 30 month follow up with hydrophilic IOLs. Vyas et al[29] observed no PCO at 2 years follow up with both hydrophobic and hydrophilic IOLs. These results are in contrast to our study and many other studies.[14,15,18,23,24]

In our study, Elschnig pearls was the predominant type of PCO, seen in 136 (68%) eyes followed by fibrous in 41 (20.5%) eyes, and mixed (Elschnig pearls as well as fibrous) in 23 (11.5%) eyes. Acrylic hydrophilic type of IOL material was predominantly associated with Elschnig pearls type of PCO (71.8%). It was also the predominant type of PCO seen overall (136 eyes out of 200 eyes). It was also the most common type of PCO associated with phacoemulcification surgery seen in 112/136 (82.4%) eyes, as compared to 24/62 (17.6%) eyes in SICS. By using Chi square goodness fit test (p value <0.01), a significant association was found between the phacoemulsification surgery and development of Elschnig pearls type of PCO as compared to SICS.

Khan et al[19] in 2006 studied 58 patients, out of which 62% predominantly developed capsular fibrous type of PCO, while 20.7% developed Elschnig pearls and in 15.5% capsular wrinkling was found.

In our study it was observed that patients with grade I of Elschnig peals and fibrous type of PCO did not interfere with visual acuity and patients did not need laser capsulotomy.

SUMMARY

Despite advances in our understanding of the mechanism of PCO formation, it remains a significant problem. However there has been a reduction in the incidence of PCO with surgical technique like thorough cortical cleanup and use of hydrophobic lenses. Hydrophobic intraocular lens material causes increased adhesion between the capsule and lens implant and this adhesion has been postulated to be a factor in the reduced amount of PCO seen with this type of implant.[14-16,140] Therefore the use of hydrophobic intraocular lenses should be advisable because they are associated with the reduced amount of PCO development. Furthermore since complete surgical removal of LECs is not possible with modern surgical technique, the migration of remaining equatorial LECs which form PCO may be difficult to avoid. As PCO is a proliferative pathological process there is a close relationship between the severity of PCO and postoperative follow up time.

REFERENCES

1. Apple DJ, Peng Q, Visessook N, Werner L, Pandey SK, Escobar M, et al.Eradication of posterior capsule opacification: documentation of a marked decrease in Nd:YAG laser posterior capsulotomy rates noted in an analysis of 5416 pseudophakic human eyes obtained postmortem. Ophthalmology, 2001; 108: 505-18.
2. Schaumberg DA, Dana MR, Christen WG, Glynn RJ. A systematic overview of the incidence of posterior capsule opacification. Ophthalmology, Jul, 1998; 105(7): 1213-21.

3. Apple DJ, Solomon KD, Tetz MR. Posterior capsule opacification. Surv Ophthalmol, Sep-Oct, 1992; 37(2): 73-116.
4. Apple DJ, Peng Q, Visessook N, Werner L, Pandey SK, Escobar M, et al. Surgical prevention of posterior capsule opacification. Part 1: Progress in eliminating this complication of cataract surgery. J Cataract Refract Surg., Feb, 2000; 26(2): 180-7.
5. Heatley CJ, Spalton DJ, Kumar A. Comparison of posterior capsule opacification rates between hydrophilic and hydrophobic single-piece acrylic intraocular lenses. J Cataract Refract Surg, Apr, 2005; 31(4): 718-24.
6. Hayashi K, Hayashi H.Posterior capsule opacification in the presence of an intraocular lens with a sharp versus rounded optic edge. Ophthalmology, Sep, 2005; 112(9): 1550-6.
7. Iwase T, Nishi Y, Oveson BC, Jo YJ. Hydrophobic versus double-square-edged hydrophilic foldable acrylic intraocular lens: effect on posterior capsule opacification. J Cataract Refract Surg, Jun, 2011; 37(6): 1060-8.
8. Wren SME, Spalton DJ, Jose R, Boyce J, Heatley CJ. Factors that influence the development of posterior capsule opacification with a polyacrylic intraocular lens. Am J Ophthalmol, Apr, 2005; 139(4): 691-5.
9. Werner L. Biocompatibility of intraocular lens materials. Curr Opin Ophthalmol, Jan, 2008; 19(1): 41-9.
10. Kohnen E, Fabian E, Gerl R, Hunold W, Heutz W, Strobel J, et al. Optic edge design as long-term factor for posterior capsular opacification rates. Ophthalmology, Aug, 2008; 115(8): 1308-14.
11. Nagamoto T, Fujiwara T. Inhibition of lens epithelial cell migration at the intraocular lens optic edge: role of capsule bending and contact pressure. J Cataract Refract Surg, 2003; 29: 1605-12.
12. Nishi O, Nishi K, Sakanishi K.Inhibition of migrating lens epithelial cells at the capsular bend created by the rectangular optic edge of a posterior chamber intraocular lens. Ophthalmic Surg Lasers, Jul, 1998; 29(7): 587-94.
13. Nixon DR, Apple DJ.Evaluation of lens epithelial cell migration in vivo at the haptic-optic junction of a one-piece hydrophobic acrylic intraocular lens. Am J Ophthalmol, Oct, 2006; 142(4): 557-62.
14. Nixon DR, Apple DJ.Evaluation of lens epithelial cell migration in vivo at the haptic-optic junction of a one-piece hydrophobic acrylic intraocular lens. Am J Ophthalmol, 2006, Oct; 142(4): 557-62.
15. Moin M, Raza K, Ahmad A. Posterior capsular opacification after PMMA and hydrophobic acrylic intraocular lens implantation. Pak J Ophthalmol, 2009; 25: No.4.
16. Mohan Lal Gupta et al. Visual benefits of Nd-YAG laser capsulotomy in south eastern rajasthan. Int J Biol Med Res., 2002; 3(4): 2507-14.
17. Fine IH. Cortical cleaving' hydrodissection. J Cataract Refract Surg, 1992; 18: 508-12.
18. Hollick EJ BA, Spalton DJ, Ursell, Pande MV, et al. The effect of polymethyl methacrylate, silicone and polyacrylic intraocular lenses on posterior capsular opacification 3 years after cataract surgery. Ophthalmology, 1999; 106: 49-55.
19. Khan YM, Jan S, Khan NM, Khan S, Kundi N. Visual outcome after Nd-YAG capsulotomy in posterior capsular opacification. Pak J Ophthalmol, 2006; 22: 2.
20. Aurangzeb Shaikh, Faheemullah Shaikh, Jai Ram Adwani and Ziauddin Ahmed Shaikh Prevalence of different Nd:YAG Laser induced complication in patients with significant posterior capsule opacification and their correlation with time duration after standard cataract surgery.
21. Hiroshi Ando MD, Nobuyo Ando MD, Tetsuro Oshikha MD, Cumulative probability of neodymium:YAG laser posterior capsulotomy after phacoemulsification cataract refract surg, 2003: 2148-54
22. Wainszteuin.j cataract refract surg, 1992; 18(6): 586-8.
23. Khanzada MA, Gul S, Dabir SA, Jatoi SM, Narsani AK. Comparative incidence of posterior capsular opacification in AcrySof and PMMA intraocular lenses. Int J Ophthalmol, 2009; 2(2): 150-153
24. Hayashi K, Hayashi H, Posterior calpsule opacification after implantation of a hydrogel intraocular lens. Br J Ophthalmol, 2004; 88: 182-5.
25. Ying Li , Jiaxing Wang , Zhuo Chen, Xin Tang Effect of Hydrophobic Acrylic versus Hydrophilic Acrylic Intraocular Lens on Posterior Capsule Opacification: Meta-Analysis. PLos one 8(11): e77864. doi:10.1371/journal.pone.0077864
26. Ahmed R, Ghayoor I, Malik M, Tabssum G,Ahmed F. Comparison between Acrylic Hydrophilic and Acrylic Hydrophobic Intraocular Lens after Phacoemulsification pak j ophthalmol, 2011; 27: 195-9.
27. Antony S, Glen T, Fernado, Basil B, Crayford.Posterior capsule opacification and lens epithelial cell layer formation: Hydroview hydrogel versus AcrySof acrylic intraocular lenses.Cataract Refract Surg, 2001; 27: 1047-54.
28. Spratt HAC, Khan Y, Claou' C.PCO and Nd:YAG Capsulotomy Rates After Centerflex™ IOLImplantation:30-Month Results.
29. Ana HS.Two year result with centerflex look promising. Euro Time, 2002; 75: 14.