Secondary piggyback with PMMA IOL for the correction of refractive surprise after phacoemulsification.

Long-term results of 20 cases

Piggyback secundário com LIO de PMMA para correção de surpresa refracional pós-facoemulsificação.

Resultados a longo prazo de 20 casos

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ABSTRACT

Purpose: To evaluate long-term results of the secondary piggyback technique used for the correction of undesired ametropia after phacoemulsification. Methods: Retrospective study comprising of 20 eyes (19 patients). The IOL used was a single-piece PMMA with an overall length of 12.5mm, a 5x6mm oval thin-edged optic with a 10-degree haptic angulation. The same technique was used in all cases, consisting of a scleral-corneal tunnel with a 5mm opening, through which the secondary intraocular lens was implanted into the ciliary sulcus. Results: The undesired ametropia was corrected in all cases. No complications were observed during or after the secondary piggyback procedure. Conclusion: The use of a single-piece PMMA IOL proved to be safe and effective in secondary piggyback for the correction of refractive surprises after phacoemulsification.

Keywords: Refractive errors; Phacoemulsification/adverse effects; Intraocular lenses; Ophthalmologic surgical procedures/methods

RESUMO

Objetivo: Avaliar os resultados a longo prazo da técnica do piggyback secundário utilizada para a correção de ametropia indesejável pós-facoemulsificação. Métodos: Estudo retrospectivo que compreendeu 20 olhos (19 pacientes). A LIO utilizada foi de peça única de PMMA de 12,5 mm de comprimento total, com óptica oval de 5x6mm, com borda fina e arredondada e angulação de 10 graus com as hápticas. A mesma técnica cirúrgica foi utilizada em todos os casos, consistindo na confecção de túnel esclero-corneano com 5mm de largura, através do qual foi implantada a lente secundária no sulco ciliar. Resultados: A ametropia indesejável foi corrigida em todos os casos. Não foi observado qualquer tipo de complicação durante ou após a cirurgia do piggyback secundário. Conclusão: A utilização de LIO de peça única de PMMA foi segura e eficaz no piggyback secundário para a correção das surpresas refracionais pós-facoemulsificação.

Descritores: Erros de refração; Facoemulsificação/efeitos adversos; Lentes intraoculares; Procedimentos cirúrgicos oftalmológicos/métodos

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INTRODUCTION

Despite the scientific and technological advances that enable us to perform biometry and keratometry with increasing precision, employ more accurate formulas to calculate IOLs, and manufacture IOLs in a more controlled manner, refractive surprises after phacoemulsification occasionally occur. Such undesirable postoperative refractive errors cause considerable frustration and should be corrected as soon as possible. Surgical correction can be performed on the cornea or in the intraocular environment.

The original IOL can be removed and exchanged for another lens with the right dioptric value to correct the refractive error. However, a more conservative intraocular approach can also be used, namely the implantation of a second IOL into the ciliary sulcus, while the first IOL is implanted within the capsular bag. This procedure, called secondary piggyback, is the object of this retrospective study.

METHODS

A total of 20 eyes (10 REs and 10 LEs) in 19 patients (15 women and 4 men) underwent secondary piggyback to correct refractive surprises. The age of patients ranged from 41 to 78 years, with a mean of 64.3 years.

In all cases, the lens used for secondary piggyback in the ciliary sulcus was the single-piece PMMA-Slim™ manufactured by Mediphacos, with the following specifications:
- Total length of 12.5 mm;
- 5x6 mm oval optic with a thin rounded edge;
- Optic-haptic angulation: 10 degrees.

To calculate the dioptric power of the IOL needed to achieve emmetropia, the following formula was used:

Residual spherical equivalent x 1.0 in cases of myopic surprise and x 1.5 in cases of hyperopic surprise.

The same surgical technique was used in all cases by the same surgeon, consisting of a curved scleral incision approximately 2 mm from the limbus at the central portion, construction of a 5-mm wide sclero-corneal tunnel, and entry into the anterior chamber with production of a corneal valve. This type of incision, called a “frown incision,” aims to reduce incision-induced astigmatism\(^m\).

Secondary lens implantation was then performed in the ciliary sulcus at the meridian providing better IOL stability and centralisation (Figure 1).

Peribulbar anaesthetic block with 2% lidocaine was used in all cases.

RESULTS

For each case, the following data were collected (Table 1). Of the 20 cases of secondary piggyback included in the study, 10 were performed to correct myopic surprises (cases 1, 2, 5, 6, 7, 8, 13, 16, 17, 20), 8 were performed to correct hyperopic surprises (cases 4, 9, 10, 11, 12, 14, 15, 19) and 2 were performed to improve near vision (cases 3, 18) (Table 1).

Table 1 shows that the difference between desired and achieved refraction (equivalent spherical diopter) after secondary piggyback was minimal.

The longest follow-up period after secondary piggyback was 6 years and 11 months (case 2) and the shortest was 3 months (case 19). The mean follow-up period was 31.6 months (Table 1).

DISCUSSION

Undesirable refractive errors post-cataract surgery can be treated surgically in various ways.

Explantation of the original IOL followed by insertion of a new IOL with the correct dioptric power is a difficult procedure that entails a higher risk than other alternatives. This procedure should be used only in the extremely rare cases of very large refractive errors, and surgical correction should be done as soon as possible, before the formation of capsular adhesions with the IOL.

Implantation of a second IOL in the ciliary sulcus in front of the original IOL, which must be fully implanted within the capsular bag, is a simpler, faster, more accurate and much safer procedure than the IOL exchange. Another important advantage of secondary piggyback versus IOL exchange is that it is not necessary to know the cause of the postoperative refractive surprise, i.e., whether the error occurred during keratometry or biometry, in manufacturing the IOL, in using an inadequate formula for calculating the IOL, etc. All these issues become irrelevant to solving the problem, as the solution does not depend on knowing its cause.

Several types of IOL can be used in secondary piggyback: Foldable lenses of various materials and designs as well as traditional hard polymethylmethacrylate (PMMA) lenses. The latter require a larger incision for implantation.

Importantly, an angulation should exist between the optic and haptic parts of the IOL. The edges of the optic part should preferably be rounded. All these recommendations aim to prevent complications that can occur after secondary piggyback in the ciliary sulcus, such as pupillary capture, pigment dispersion due to friction of the second lens with the posterior surface of the iris, pigmentary glaucoma, areas of transillumination of the iris, hyphema, and vitreous haemorrhage\(^n\).

Currently, hydrophobic acrylic lenses are the most commonly used single-piece lenses, without angulation between the optic and haptic parts, which makes them inappropriate for secondary piggyback in the ciliary sulcus. This type of lens requires implantation exclusively within the capsular bag. The haptics of these lenses are relatively thick and have a straight edge. If, for

Figure 1: Scleral “frown incision” with sclero-corneal tunnel and secondary piggyback with an oval PMMA IOL in the ciliary sulcus
Table 1
Secondary piggyback with PMMA IOL to correct refractive surprises after phacoemulsification

| Case | Idade (anos) | Sexo | Olho operado | Refração pré-Faco + Línea (sph) corrigida | Acuidade Visual pós-Faco/Línea (log mar) corrigida | Intervalos Facef-LOI piggyback secundário | Poder Óptico LED Piggyback secundário | Refração pós-Desejada pós-Piggyback secundário | Refração pós-Piggyback secundário | Refração pós-desejada - Refração alcançada pós-Piggyback secundário | Acuidade visual corrigida pós-Piggyback secundário | Seguimento pós-Piggyback secundário |
|------|-------------|------|--------------|------------------------------------------|-----------------------------------------------|----------------------------------------|---------------------------------|------------------------------------------|--------------------------------|--------------------------------|---------------------------------|--------------------------------|-----------------------------|
| 1    | 50          | Feminino | OE         | -50.00 (-0.00 x 180) | 20/20 30 dias                           | -0.50                              | 0.00 | -0.25 (-0.50 x 186) | -0.25                              | 0.00 | 0.25 (-0.50 x 186) | 0.25                              | 0.00 | 6 anos 3 meses             |
| 2    | 74          | Feminino | OD         | -70.00 (-1.00 x 180) | 20/20 30 dias                           | -7.00                              | 0.00 | -0.75 (-0.75 x 155) | -0.75                              | 0.00 | 0.75 (-0.75 x 155) | 0.75                              | 0.00 | 6 anos 11 meses            |
| 3    | 55          | Masculino | OD         | -5.00 (+0.00 x 180) | 20/20 120 dias                          | 5.00                               | -2.00 | 2.00                  | 2.00                               | 0.00 | 0.00                  | 0.00                              | 0.00 | 1 ano 6 meses             |
| 4    | 56          | Feminino | OE         | -50.00 (+0.00 x 180) | 20/20 60 dias                           | -7.00                              | 1.50 | -1.50                  | -1.50                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 4 meses                   |
| 5    | 68          | Feminino | OD         | -70.00 (-1.00 x 15) | 20/20 5 anos 8 meses                    | -7.00                              | 1.75 | -1.75                  | -1.75                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 4 anos 7 meses            |
| 6    | 41          | Feminino | OD         | -2.50 (-0.00 x 186) | 20/20 7 dias                            | -3.00                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 5 anos 9 meses            |
| 7    | 62          | Masculino | OD         | -1.50 (-0.00 x 186) | 20/20 60 dias                           | -4.50                              | -2.00 | -2.00                  | -2.00                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 1 ano 8 meses             |
| 8    | 69          | Feminino | OE         | -2.50 (+0.00 x 180) | 20/20 120 dias                          | 2.00                               | -0.00 | -0.50                  | -0.50                              | 0.00 | 0.50                  | 0.50                              | 0.00 | 2 anos                   |
| 9    | 65          | Feminino | OE         | -50.00 (+0.00 x 180) | 20/20 7 dias                            | -4.00                              | 0.00 | -1.50                  | -1.50                              | 0.00 | 0.50                  | 0.50                              | 0.00 | 2 anos                   |
| 10   | 78          | Masculino | OD         | -5.00 (+0.00 x 180) | 20/20 6 anos 5 meses                    | -6.00                              | -1.25 | -1.25                  | -1.25                              | 0.00 | 0.25                  | 0.25                              | 0.00 | 2 anos                   |
| 11   | 78          | Feminino | OE         | -2.50 (+0.00 x 180) | 20/20 3 anos                            | -2.00                              | -1.00 | -1.00                  | -1.00                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 3 anos 7 meses            |
| 12   | 53          | Masculino | OE         | -3.25 (+2.50 x 85) | 20/20 4 anos                            | -4.00                              | 0.00 | -3.75                  | -3.75                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 1 ano 7 meses            |
| 13   | 65          | Masculino | OD         | -5.00 (+0.00 x 45) | 20/20 6 anos 5 meses                    | -5.00                              | -1.25 | -1.25                  | -1.25                              | 0.00 | 0.25                  | 0.25                              | 0.00 | 3 anos 11 meses           |
| 14   | 65          | Masculino | OD         | -1.50 (+0.00 x 186) | 20/20 3 anos                            | -3.00                              | -0.50 | -0.50                  | -0.50                              | 0.00 | 0.50                  | 0.50                              | 0.00 | 1 ano 7 meses            |
| 15   | 62          | Feminino | OE         | -1.50 (+0.00 x 186) | 20/20 2 meses                           | -3.00                              | -2.00 | -2.00                  | -2.00                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 1 ano 7 meses            |
| 16   | 68          | Feminino | OD         | -1.50 (+0.00 x 75) | 20/20 2 anos                            | -2.00                              | 1.00  | -1.00                  | -1.00                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 1 ano 2 meses            |
| 17   | 47          | Feminino | OD         | -4.90 (+0.00 x 186) | 20/20 3 anos                            | -5.00                              | 0.00 | -3.50                  | -3.50                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 1 ano 2 meses            |
| 18   | 78          | Feminino | OD         | -0.25 (+0.00 x 180) | 20/20 1 mes                             | -3.50                              | -2.25 | -2.25                  | -2.25                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 1 ano 5 meses            |
| 19   | 84          | Feminino | OD         | -1.50 (+0.00 x 180) | 20/20 1 ano                             | -2.00                              | -1.50 | -1.50                  | -1.50                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 3 anos                   |
| 20   | 78          | Feminino | OD         | -6.90 (+0.00 x 180) | 20/20 2 anos                            | -7.50                              | 0.00 | -2.50                  | -2.50                              | 0.00 | 0.00                  | 0.00                              | 0.00 | 2 anos                   |

MÉDIA: 64.3
DESVIO PADRÃO: 10.3
R: 41
N: 78

Figure 1. Ultrasound biomicroscopy showing the original lens in the capsular bag and the single-piece PMMA IOL, used for secondary piggyback, in the posterior chamber, with support in the ciliary sulcus.

Figure 2. Ultrasound biomicroscopy showing the intraocular lens in the capsular bag and a large posterior chamber some reason, the haptic is outside the capsular bag, friction with the posterior surface of the iris or even with the ciliary body can cause complications such as uveitis, glaucoma, and haemorrhage.

Therefore, their use is absolutely contraindicated for secondary piggyback in the ciliary sulcus. Three-piece hydrophobic acrylic or silicone lenses with optic/haptic angulation are suitable for this purpose. More recently, foldable lenses have been developed specifically for secondary piggyback in the ciliary sulcus: The single-piece hydrophilic acrylic IOL called Sulcoflex™, manufactured by Rayner, and the three-piece lens with a silicone optic and PMMA haptics called Add-On™, manufactured by HumanOptics, with monofocal, both with toric and bifocal versions. However, the purpose of this retrospective study was to show that old single-piece PMMA lenses with an oval optic were useful in secondary piggyback for correcting refractive surprises after phacoemulsification.
Secondary piggyback with PMMA IOL for the correction of refractive surprise after phacoemulsification. Long-term results of 20 cases

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