Assessment of intra-operative techniques to prevent visual axis opacification in congenital cataract surgery

R. Borghol-Kassar a,*, J.L. Menezo-Rozalén b, M.A. Harto-Castaño c, M.C. Desco-Esteban b

a Servicio de Oftalmología, Hospital de Manacor, Manacor, Mallorca, Spain
b Servicio de Oftalmología, Fundación Oftalmológica del Mediterráneo, Valencia, Spain
c Unidad de Oftalmología Pedriátrica, Hospital Universitari La Fe, Valencia, Spain

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ABSTRACT

Objective: To evaluate the effectiveness of various surgical procedures in the management of posterior capsule and anterior vitreous for the prevention of visual axis opacification.

Methods: We retrospectively reviewed 120 eyes operated for unilateral congenital cataracts, with a median age at the time of cataract surgery of 21 months (interquartile range, 6–52 months). The eyes were divided into three groups: group 1 (eyes with intact posterior capsule, n = 39), group 2 (eyes with posterior continuous curvilinear capsulorhexis, n = 38), group 3 (eyes with posterior continuous curvilinear capsulorhexis and anterior vitrectomy, n = 43).

Results: To determine the effect of posterior continuous curvilinear capsulorhexis on visual axis opacification we compared group 2 with group 1 (chi-square Pearson test, P = .281), therefore in this study the implementation of the posterior continuous curvilinear capsulorhexis did not show any decrease in the incidence of visual axis opacification. To study the effect of posterior continuous curvilinear capsulorhexis associated anterior vitrectomy, we compared group 3 with group 1 (chi-square Pearson test, P = .014), demonstrating that the combination of both techniques (posterior continuous curvilinear capsulorhexis and anterior vitrectomy) decreases the incidence of visual axis opacification.

Conclusion: Posterior continuous curvilinear capsulorhexis as a single technique did not show any decrease in the incidence of visual axis opacification. Posterior continuous curvilinear capsulorhexis together with anterior vitrectomy is required to prevent visual axis opacification and to decrease reoperation rate.

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* Corresponding author.
E-mail address: rborghol@hospitalmanacor.org (R. Borghol-Kassar).
Valoración de técnicas intraoperatorias para la prevención de la opacificación del eje visual en la cirugía de cataratas congénitas

**RESUMEN**

**Palabras clave:**
Cataratas congénitas
Opacificación eje visual
Capsulorrexis posterior circular continua
Vitrectomía anterior

**Objetivo:** Evaluar la efectividad de varios procedimientos quirúrgicos en el manejo de la cápsula posterior y del vitreo anterior sobre la prevención de la opacificación del eje visual.

**Sujetos, material y métodos:** Realizamos un estudio retrospectivo sobre 120 ojos intervenidos de cataratas congénitas unilaterales con una mediana de edad en el momento de la cirugía de 21 meses (rango intercuartílico, 6–52 meses). La población se divide en 3 grupos: grupo 1 (ojos con cápsula posterior íntegra, n = 39), grupo 2 (ojos con capsulorrexis posterior circular continua, n = 38) y grupo 3 (ojos con capsulorrexis posterior circular continua y vitrectomía anterior, n = 43).

**Resultados:** Respecto al efecto de la capsulorrexis posterior circular sobre la opacificación del eje visual se comparan el grupo 2 con el grupo 1 (chi-cuadrado de Pearson, p = 0,281), por tanto, la realización de la capsulorrexis posterior circular no ha demostrado en este trabajo disminuir la incidencia de opacificación del eje visual. En cuanto al efecto de la capsulorrexis posterior circular asociada a la vitrectomía anterior, se comparan el grupo 3 con el grupo 1 (chi-cuadrado de Pearson, p = 0,014), lo que demuestra que la unión de ambas técnicas (capsulorrexis posterior circular y vitrectomía anterior) sí disminuye la incidencia de opacificación del eje visual.

**Conclusiones:** La capsulorrexis posterior circular como única técnica no ha demostrado disminuir la incidencia de la opacificación del eje visual, siendo necesaria la realización de la capsulorrexis posterior circular asociada a la vitrectomía anterior para prevenir la opacificación del eje visual y disminuir la tasa de reintervenciones.

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**Introduction**

Visual axis opacification (VAO) is the most frequent complication after pediatric cataract surgery, with a prevalence exceeding 95%. VAO is the most significant obstacle for visual rehabilitation and the main cause of re-interventions in children with primary intraocular lens (IOL) implant.

In order to eliminate or reduce VAO, various surgical techniques have been designed for exclusive or combined surgery, including continuous circular posterior capsulorhexis (CCPC), anterior vitrectomy (AV) and capturing the IOL optic behind the CCPC.

The objective of this paper is to assess the effectiveness of several surgical procedures in the management of posterior capsule and anterior vitreous on VAO, assessing whether executing CCPC as a single technique or in combination with AV diminishes the prevalence of VAO in comparison with cases in which the posterior capsule is kept intact.

**Subjects, material and methods**

A retrospective study on 120 eyes intervened for unilateral congenital cataracts consecutively between January 1982 and September 2004.

All the interventions were performed by 3 surgeons with similar surgical procedures under general anesthesia and after anterior capsulotomy the lens material was removed with a Simcoe cannula. In the first group, the posterior capsule was left intact (n = 39), in the second group (38 eyes) only CCPC was performed and finally in the third group CCPC was performed in association with AV, totaling 43 eyes (Table 1). In 83 eyes an intraocular lens was implanted, with 37 eyes being aphakic. Residual viscoelastic was removed with a Simcoe cannula and the incision was closed with continuous or non-continuous sutures with nylon 10–0.

In the descriptive study, data have been expressed as mean and interquartile range (IQR). In the bivariate analysis the variables to be compared are dichotomic; accordingly, Pearson’s Chi-square statistical test has been applied with a significance of 5% (α = 0.05). Therefore, any P-value <.05 indicates a statistically significant difference. On the contrary, a P-value >0.05 indicates the absence of a difference. In order to demonstrate that the groups are homogeneous vis-à-vis some variables (age at the intervention and IOL insertion) which could bias results, a homogeneity Chi-square test was performed with a significance level of 5%. Data were analyzed utilizing the SPSS® version 12.0 software (SPSS Inc, Chicago, III, USA.).

**Results**

The sample (120 eyes) corresponded to 66 boys and 54 girls. Forty-eight percent of patients had the right eye operated and 52% the left eye. The mean age at surgery time in the entire sample was 21 months (IQR 6–52 months), 21 months (IQR 9–93 months) in group1, 18 months (IQR 4–47 months) in group 2 and 24 months (IQR 8–46 months) in group 3 (Table 1).

In what concerns the percentage of IOL implants in each group, in the 83 pseudophakic eyes this percentage was 26
eyes (67%) in group 1, 28 eyes (74%) in group 2 and 29 eyes (67%) in group 3. In the remaining 37 aphakic eyes, the said percentage was 13 eyes (33%) in group 1, 10 eyes (26%) in group 2 and 14 eyes (33%) in group 3 (Table 1).

The asymptotic significance values for the age of intervention and IOL insertion variables in the 3 groups are greater than 0.05 (Table 1), which demonstrate that the 3 groups are homogeneous and comparable.

Analyzing the incidence of VAO it was seen that it arises in 36% of cases, with the mean time elapsed between the intervention and the opacity being of 15 months (range, 1–50 months), with the mean value being 12 months.

As regards the assessment of the effects of CCPC on VAO, 38 eyes that had CCPC were compared (group 2) with the 39 eyes which had the posterior capsule intact (group 1). The results of Pearson’s Chi square statistical test were not statistically significant (P = .281). Therefore, it was not possible to demonstrate that CCPC reduces the incidence of VAO.

As regards the effect on VAO of the joint intervention comprising CCPC and AV, 43 eyes (group 3) were compared with 39 eyes (group 1). Once again, Pearson’s Chi square statistical test was utilized, yielding a P value of .014, which demonstrates that the Association of both techniques (CCPC and AV) does diminish the incidence of VAO. Fig. 1 shows these differences and it can be appreciated that the incidence of VAO is reduced 27% in the eyes submitted to both techniques (CCPC and AV), in comparison with the group of eyes with intact anterior capsules.

To analyze possible differences between the CCPC group (group 2) and the CCPC and AV group (group 3), Pearson’s Chi square statistical test was performed again, obtaining a P value of 0.165 (>0.05). Accordingly, no significant differences were found in the incidence of VAO between both groups. In other words, one technique (CCPC and AV) prevents VAO while the other (CCPC) does not, even though a comparison between both does not yield differences. These apparently contradictory results are due to the magnitude of the differences. The inequalities between opacity in the eyes with intact posterior capsule and those in which CCPC was the only intervention are not sufficiently strong to be significant. The same occurs between those intervened with CCPC exclusively and those who had both techniques performed (CCPC and AV). However, the differences found between eyes with intact posterior capsule and those who underwent both surgical techniques are sufficiently large to become significant. Fig. 2 clearly illustrates this situation.

The 3 results obtained are summarized in Table 2.

### Discussion

In what concerns the effect of CCPC over VAO, published results are highly variable as well as heterogeneous. Jensen et al.\(^4\) concluded that it is advisable to perform CCPC in children under 6 years of age and to leave the posterior capsule intact in older phakic children.

Er et al.\(^5\) carried out a study on 47 eyes of 34 children aged between 40 days and 18 years. In 26 cases they performed CCPC and in 21 eyes the posterior capsule was left intact. With a mean follow-up time of 10 months (6.5 months–5 years), they concluded that CCPC is an efficient method for preventing VAO albeit in the short term. In our view, a follow-up time of 10 months is too short to assess the efficacy of a technique, as in our study the mean time between the intervention and the appearance of VAO was calculated to be of 15 months (range, 1–50 months).

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**Table 1 – Surgery technique groups.**

<table>
<thead>
<tr>
<th>Surgery technique</th>
<th>Number of cases</th>
<th>Mean (months)</th>
<th>IQR (months)</th>
<th>Pseudophakic/aphakic %</th>
<th>SA, age</th>
<th>SA, IOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intact capsule (group 1)</td>
<td>39</td>
<td>21</td>
<td>9–85</td>
<td>67/33</td>
<td>0.99</td>
<td>1</td>
</tr>
<tr>
<td>CCPC (group 2)</td>
<td>38</td>
<td>18</td>
<td>4–47</td>
<td>74/26</td>
<td>0.89</td>
<td>1</td>
</tr>
<tr>
<td>CCPC and AV (group 3)</td>
<td>43</td>
<td>24</td>
<td>8–46</td>
<td>67/33</td>
<td>0.99</td>
<td>1</td>
</tr>
<tr>
<td>Sample total</td>
<td>120</td>
<td>21</td>
<td>6–52</td>
<td>69/31</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CCPC: continuous circular posterior capsulorhexis; IOL: intraocular lens; IQR: interquartile range; SA: asymptotic significance; AV: anterior vitrectomy.

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![Fig. 1 – Visual axis opacification differences between surgical techniques. CCPC: Continuous circular posterior capsulorhexis.](image)

![Fig. 2 – Visual axis opacification percentage for each surgical technique. CCPC: Continuous circular posterior capsulorhexis.](image)
Fenton and O’Keefe\textsuperscript{6} made a study on 32 eyes (23 congenital cataracts, 6 evolutionary cataracts and 3 traumatic cataracts) of 22 children with a surgery age range of one month to 12 years and a mean follow-up period of 22 months (6–50 months). After performing extracapsular surgery with anterior and posterior capsulohypnosis with radiofrequency and without performing AV, they referred that 84.4% of cases maintained visual axis transparency up to the last follow-up. This group concluded that CCPC without vitrectomy is an efficient method for preventing VAO, although they admit the necessity of longer follow-up period to confirm said results.

Lloyd et al.\textsuperscript{7} concluded that CCPC performed exclusively does not prevent VAO.

Petric and Lacmanović Loncar\textsuperscript{1} studied 33 eyes of 21 children with a mean surgery age of 39 months (4–115 months). In 24 eyes CCPC was performed associated to vitrectomy and in 9 it was performed exclusively. These authors concluded that VAO is the most frequent complication after congenital cataract surgery and that in young children it is necessary to associate VA to CCPC, whereas in older (>7 years) children it is possible to achieve visual axis transparency performing only CCPC without vitrectomy.

As regards the effectiveness of CCPC associated to VAO, the latest article was published by Luo et al.,\textsuperscript{8} who carried out a comparative study in 60 eyes of 38 children between 2 and 5 years of age. In 34 eyes they performed CCPC and AV and in 26 eyes they left the capsule intact. They concluded that CCPC together with AV is a necessary and efficient method for preventing or diminishing the incidence of VAO in children. We have confirmed these results with a larger sample (82 eyes).

Other publications\textsuperscript{9–12} obtained similar results, concluding that CCPC associated to AV diminishes the risk of VAO whereas CCPC performed as the exclusive technique does not prevent VAO.

Tuncer et al.\textsuperscript{13} made a study of 31 eyes of 21 children with cataract surgery with primary hydrophobic acrylic IOL implants, comparing 14 eyes with intact capsule and 17 eyes submitted to CCPC and AV. They concluded that the percentage of VAO which required surgery was significantly higher in the group with the intact posterior capsule, and that in order to diminish the frequency of re-interventions and maintain visual axis transparency it is necessary to perform CCPC jointly with AV. This result is similar to that presented by Hosal and Biglan\textsuperscript{14}, who concluded that CCPC combined with AV diminishes the incidence of VAO. Kugelberg and Zetterstorn\textsuperscript{15} added an additional data to the previous results, concluding that in younger children it is necessary to perform CCPC associated with AV, whereas in older children (>7 years) it is possible to achieve visual axis transparency performing CCPC by itself.

To conclude, we consider that CCPC performed on its own has not demonstrated a reduction of VAO, making it unnecessary to perform CCPC associated to AV in order to prevent VAO and diminish re-intervention rates.

**Conflict of interests**

No conflict of interest has been declared by the authors.

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