

Postoperative Changes Over Time in Size of Anterior Capsulorrhexis in Phacoemulsification/Aspiration

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Abstract: In the present study, we attempted to determine the extent to which an anterior capsulorrhexis carried out during cataract surgery contracts postoperatively. The size of the continuous curvilinear capsulorrhexis (CCC) was measured at the end of surgery and at the final follow-up examination in 52 eyes of 40 patients who underwent phacoemulsification/aspiration and implantation of an intraocular lens (IOL) with 6-mm optics. Images obtained by video during surgery and by slit-lamp microscopy were used to determine the CCC size with reference to the optics of the IOL. The average CCC size was 5.0 mm at the end of surgery; it contracted to 4.4 mm by the final postoperative examination. The contraction of the anterior capsule progressed rapidly in the first 50 days following surgery and then gradually thereafter. The extent of contraction was greater in older patients. The smaller the CCC size immediately after surgery, the more rapidly it contracted. The size of the capsulorrhexis contracted an average of 22% following cataract surgery. The contraction rate tended to be higher in older patients. The results suggest that the capsulorrhexis carried out in cataract surgery for elderly patients should be sufficiently large, but not larger than the optics size of the IOL. **Jpn J Ophthalmol 1998;42:495-498** © 1998 Japanese Ophthalmological Society

Key Words: Anterior capsule, cataract, continuous curvilinear capsulorrhexis, phacoemulsification/aspiration.

Introduction

In recent years, the preferred surgical procedure for treatment of cataracts has been phacoemulsification/aspiration following anterior capsulorrhexis by the continuous curvilinear capsulorrhexis (CCC)^{1,2,3} method. However, contraction of the capsulorrhexis has frequently been observed during the postoperative period.^{4,5,6} As the anterior capsule becomes opaque and contracts, the effective pupillary area decreases, causing a decline in visual acuity and glare disability. Extremely contracted cases require widening of the anterior capsulorrhexis with a neodymium:yttrium-aluminum-garnet laser. It is not fully known to what degree the capsulorrhexis contracts

postoperatively. The present study determined contraction by measuring the CCC size both at the end of surgery and at the final follow-up examination.

Materials and Methods

The 40 patients included in this study underwent phacoemulsification/aspiration and implantation of a single-piece intraocular lens (IOL) with 6-mm optics. Patients with tears at the rim of the anterior capsule or rupture of the capsule were excluded from the study. A total of 52 eyes were examined. Subjects ranged in age from 48 to 88 years (mean age: 73 years). The average observation period was 110 days.

The change in CCC size was measured by comparing the size of the IOL optics and the CCC size, using slit-lamp microscopy or a videotape recording of the surgery. Cases having poor mydriasis or complications such as uveitis, lens pseudoexfoliation syn-

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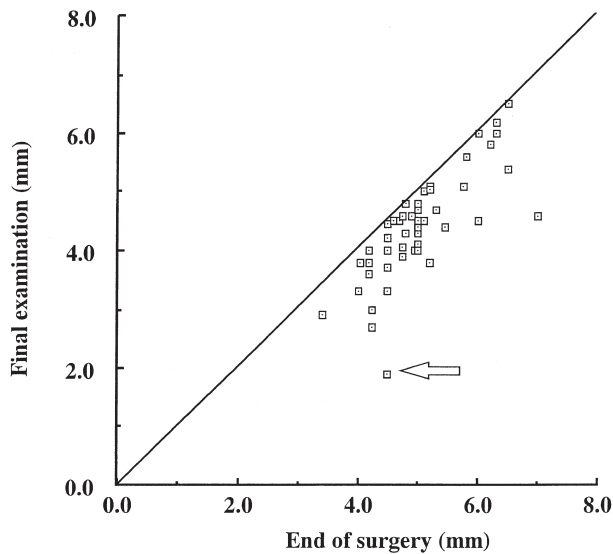


Figure 1. Scatterplot of CCC sizes at end of surgery and at final examination. While in some cases size did not change, in others a size >4 mm at the end of surgery contracted to <2 mm at final examination (indicated by arrow).

drome, and diabetes mellitus were excluded from the study. The size of the anterior capsulorrhexis was calculated using the average value of the measured long and short diameters of the CCC. Examination of CCC size was carried out with as little ocular displacement as possible.

The relationships of patient age, contraction rate,

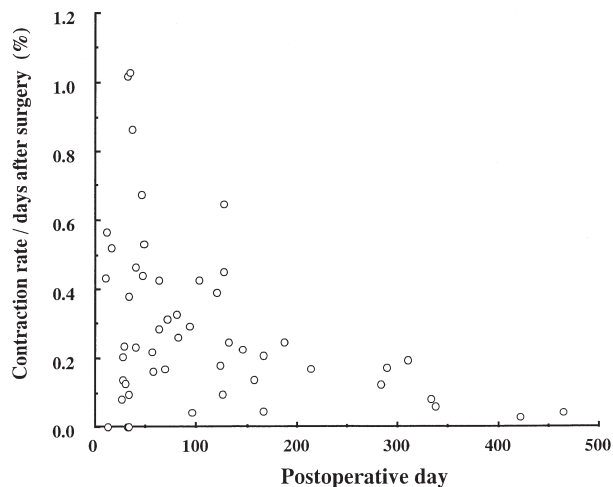


Figure 2. Contraction rate of anterior capsule following surgery. Contraction progressed rapidly for the first 50 days and gradually thereafter.

Table 1. Relationship between Extent of Contraction Rate-days after Surgery and Period after Surgery

Period after surgery (days)	Extent of contraction rate/days after surgery
≤50 (n = 23)	0.36 ± 0.32*
50 < (n = 29)	0.22 ± 0.14

(Mean ± SD) Two-tailed test, *P* < 0.05

CCC size at the end of surgery and at the final examination were studied.

Results

Figure 1 shows a scatterplot of CCC sizes at the end of surgery and those at the final examination. In some cases, CCC size did not change, whereas in others it did; one with a size >4 mm immediately after surgery contracted to <2 mm at the final examination (indicated by arrow).

Figure 2 shows the relationship between the period elapsed since surgery and the contraction rate. As shown in Table 1 and Figure 2, the contraction rate of the CCC progressed rapidly during the first 50-day period following surgery but continued gradually thereafter (two-tailed test, *P* < 0.05). Accordingly, subjects in the continuing study of the contraction rate of the anterior capsule were limited to cases where the postoperative follow-up period lasted 50 days or longer (50–465 days).

The relationship between patient age and contraction rate was studied. As shown in Table 2 and Figure 3, the contraction rate was greater in older patients. In particular, patients more than 80 years old showed an average contraction rate of 34%.

The relationship between the CCC size at the end of surgery and contraction rate was studied. As shown in Table 3 and Figure 4, the CCC size at the end of surgery was divided into three groups, and the CCC size and the contraction rate in each group was measured. The results showed that the smaller the CCC size at the end of surgery, the higher the contraction rate tended to be. A significant difference in contraction rate was seen between the group with a CCC size of <4.5 mm and the group with a size of 4.6–6.0 mm.

Discussion

Anterior capsulorrhexis by the CCC method in phacoemulsification/aspiration and IOL implantation is a safe technique that guarantees secure fixa-

Table 2. Relationship Between Patient Age and Contraction Rate

Age	CCC size at end of surgery (mm)	CCC size at final examination (mm)	Contraction rates (%)
≤70 (n = 8)	4.9 ± 0.5	4.3 ± 0.4	13.4 ± 12.7
70 ≤ 80 (n = 12)	4.6 ± 0.8	3.8 ± 0.8	30.5 ± 15.1
80 ≤ (n = 9)	5.3 ± 0.9	4.2 ± 1.1	34.6 ± 24.4
(n = 29)	4.9 ± 0.8	4.1 ± 0.8	29.9 ± 17.6

(Mean ± SD)

Table 3. Relationship Between CCC Size at End of Surgery and Contraction Rate

CCC size at end of surgery (mm)	CCC size at final examination (mm)	Contraction rates (%)
3.0 ≤ 4.6 (n = 10, 4.1 ± 0.4)	3.2 ± 0.6	38.2 ± 21.4* ←
4.6 ≤ 6.0 (n = 16, 5.1 ± 0.2)	4.4 ± 0.4	23.4 ± 11.5 ←
6.0 ≤ (n = 3, 6.4 ± 0.5)	5.0 ± 0.7	37.7 ± 22.8
(n = 29, 4.9 ± 0.8)	4.1 ± 0.8	29.9 ± 17.6

(Mean ± SD)

*Two-tailed test, $P < 0.05$

tion of an IOL.^{1,2,3} However, complications such as strongly concentric contractions of the capsule and opacity have been observed postoperatively; these occur less frequently when the can-opener method is used.^{4,5,6} A number of potential biologic factors have been reported to contribute to capsular contraction, including uveitis, retinal pigmentary degeneration, primary angle-closure glaucoma, strong myopia, and systemic vascular disorders.⁷ A high degree of con-

traction of the anterior capsule is sometimes observed even in the absence of such potential factors. In the present study, we measured the size of the anterior capsulorrhexis both at the conclusion of surgery and at the final examination, and observed the extent of contraction in patients who had no ophthalmic or systemic complications other than cataracts.

When cases with potential biologic factors were excluded, the anterior capsulorrhexis contracted an average of 22% in size following cataract surgery (Table 4). As shown in Figure 2, the size of the anterior capsulorrhexis contracted rapidly during the first 50-day period after surgery and then contracted gradually thereafter. This suggests that the contraction of the anterior capsule might be exacerbated by the inflammation in the anterior chamber in the early postoperative stage.

Joo et al⁸ reported that age and CCC size did not have a statistically significant effect on capsule contraction. The relationship between patient age and contraction rate was also studied. The contraction rate tended to increase with age (Table 1). The volume of the lenticular capsule increases with age and is reported to be 180 mm³ at age 40–50 and 210 mm³ at age 60–70.⁹ A larger lenticular capsule associated with age, together with a fragile Zinn's zonule, could account for this tendency towards increased contraction of the anterior capsule in elderly patients.

The relationship between CCC size and contraction rate was studied. A significant difference was

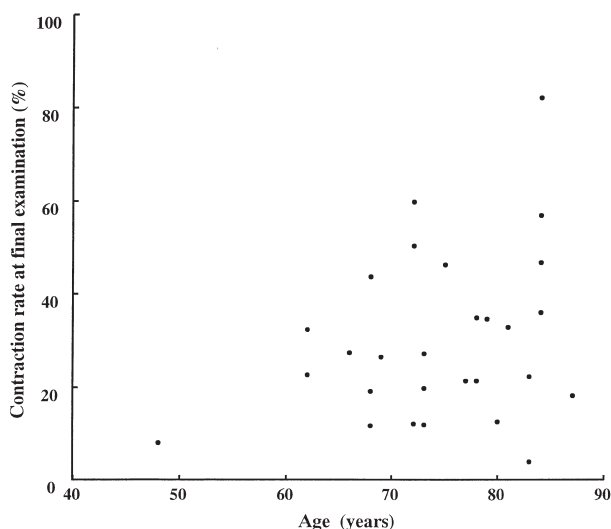


Figure 3. Scatterplot of contraction rate versus patient age. Contraction rate tended to increase with patient age.

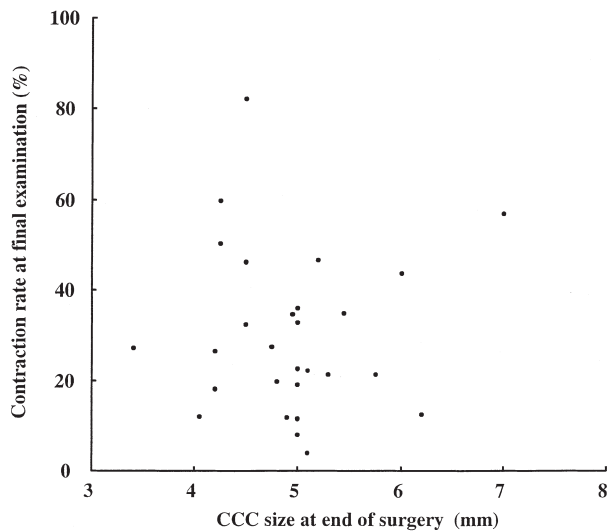


Figure 4. Results suggest that the smaller the CCC size at the end of surgery, the higher the contraction rate.

observed in the contraction rate between the groups with a CCC size of <4.5 mm and 4.6–6.0 mm. A case of the anterior capsulorhexis being completely closed despite a small CCC has been reported.¹⁰ This suggests that an anterior capsulorhexis of <4.5 mm should be avoided if possible (Table 3), and if a small size is unavoidable, the size of the anterior capsulorhexis should be enlarged after the implantation of the IOL. Although there were only three cases, the contraction rates were even higher in the group with capsule size >6.0 mm. A higher incidence of cataracts has been reported in cases where the optics of the IOL are not completely covered by the rim of the anterior capsulorhexis than in cases in which optics are covered by the rim. Postoperative adhesion of the anterior and posterior capsules seems to exacerbate the contraction, suggesting that making a CCC larger than the optics of the IOL is undesirable.

In conclusion, the present study found that the

Table 4. CCC Contraction Rate

CCC size at end of surgery:	5.0 ± 0.8mm
CCC size at final examination:	4.4 ± 1.0mm
Contraction rate:	22.2 ± 17.8%

(Mean ± SD)

size of anterior capsulorhexis contracted an average of 22% following cataract surgery, and that the contraction rate tended to be higher with increasing patient age. The results suggest that older patients who undergo cataract surgery should have an anterior capsulorhexis that is sufficiently large, but not larger than the size of optics of the IOL.

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