Reprinted from the Archives of Ophthalmology
December 1993, Volume 111

LABORATORY SCIENCES

Amplitudes of Accommodation of Primate Lenses Refilled With Two Types of Inflatable Endocapsular Balloons

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Objective: To investigate the maintenance of ocular accommodation by refilling the lenses of the eyes of youthful primates with inflatable endocapsular balloons.

Methods: The lenses of 21 cynomolgus monkeys were refilled following endocapsular phacoemulsification with a balloon that either approximates the shape of the nonaccommodated lens or the accommodated crystalline lens.

Results: In nine of 15 successfully refilled lenses, we were able to perform automated refractometry to determine the amplitude of accommodation, ie, changes in refraction before and 1 hour after application of topical 4% pilocarpine hydrochloride to alter lens shape. At 2 weeks, 2 to 3 months, and 6 to 12 months after operation, mean (±SD) accommodation was 4.6±2.5, 2.5±0.5, and 1.7±0.7 diopters (D), respectively, in the lenses refilled with the nonaccommodation balloon (n=5; preoperative value, 15.2±1.3 D), and it was 1.9±0.5, 1.3±0.9, and 1.8±0.9 D, respectively, in the lenses refilled with the accommodation balloon (n=4; preoperative value, 17.0±2.9 D).

Conclusion: The greater yield of accommodation with the nonaccommodation balloon is consistent with the recent theory on the mechanism of accommodation. Although the obtained accommodation was a small fraction of values determined prior to the operation and the small amplitude of accommodation decreased over time, the feasibility of refilling the lens with an inflatable endocapsular balloon, allowing at least some accommodation in the eyes of youthful primates, was demonstrated. Applied to humans, this procedure may allow accommodation following cataract surgery.

(Arch Ophthalmol. 1993;111:1677-1684)

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REFILLING THE lens while preserving the integrity of the lens capsule, zonule, and ciliary muscle offers the potential of restoring ocular accommodation after cataract surgery.

Kessler[1] was the first to refill a rabbit lens with silicone oil, followed by Agarwal et al.[2] The integrity of the capsular bag was difficult to maintain, mainly owing to surgical and technical problems, and, since the liquid silicone was observed to leak from the capsular bag,[1,2] Parel et al,[3] Haefliger et al,[4] and Gindi et al[5] attempted to use precured silicone polymeric gel as a filling material. These cross-linked polymethyldisiloxane compounds, which are more commonly known as silicone elastomers or silicone rubbers, offer the most appropriate properties for experimental lens refilling in terms of refractive index, biocompatibility, elasticity, transparency, and nontoxicity, although adverse reactions to silicone breast implants have recently been reported with alarming frequency.[6]

It is difficult to prepare a precured silicone gel with viscosity that is both low enough to allow injection through a small-gauge needle and high enough not to leak. Yet, these physical properties must be similar to those of the crystalline lens. Also, because silicone has a lower specific gravity than water and is not cohesive enough to replace fluid in the capsular bag, it is technically extremely difficult to fill the bag with this material.

To overcome these difficulties, Nishi[7] developed an inflatable endocapsular balloon and used it to refill the lens capsules of animal eyes.[8] The balloon is inserted into the collapsed, empty

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MATERIALS AND METHODS

PREPARATION OF INFLATABLE ENDOCAPSULAR BALLOON

The disc-shaped inflatable endocapsular balloon[8] has walls that are approximately 20 μm thick and consist of silicone polymer. The balloon is composed of an inflatable optical part and a delivery tube.

The inflatable optical part was made according to the measurements of the lenses of *Macaca fascicularis* (cynomolgus monkey). The anterior segments of the eyes of the 21 male and female monkeys (age range, 4 to 6 years; weight range, 3 to 5 kg) were photographed with a slit-lamp Scheimpflug camera[9] (Nidek Company, Gamagori, Japan) during nonaccommodation and accommodation, ie, before and 1 hour after topical application of 4% pilocarpine hydrochloride. Two to 3 weeks before photographing the lens, sector iridectomies were performed at the 6- and 12-o'clock positions to maximize visualization (**Figure 1**).

The microphotographs were analyzed by the image analyzer included with the Scheimpflug camera to determine the lens dimensions: equatorial and axial lens diameters and anterior and posterior curvatures. The invisible equator was determined as follows. The points where the extensions of the anterior and posterior curvatures meet were first determined. Then, for the shape in the nonaccommodated state, a circle, 0.5 mm in diameter, that touched tangentially both curvatures at the equator angle was delineated. The part of the circumference between the two contact points was determined as the equatorial shape. For the shape in the accommodated state, a circle, 0.3 mm in diameter, was used. This diameter was arbitrarily chosen on the basis of the shape of the lens equators that could be photographed. Accordingly, the obtained diameters ranged from 7.8 to 8.8 mm (mean, 8.4±0.4 mm) in the nonaccommodated state and from 7.0 to 8.2 mm (mean, 7.5±0.4 mm) in the accommodated state, ie, 1 hour after the topical application of 4% pilocarpine.

Two types of balloons were developed. The nonaccommodation balloon approximating the shape of the lens in the nonaccommodative state was constructed according to the values obtained during nonaccommodation of the lens; the accommodation balloon approximating the shape of the lens in the accommodative state, according to the values obtained during accommodation. For each type, balloons of two different diameters were made (**Table 1** and **Figure 2**).

A thin delivery tube (outer diameter, 0.365 mm; inner diameter, 0.305 mm) was positioned at the preequatorial zone. After the air was evacuated from the balloon through the delivery tube, the inner lumen of the delivery tube was filled with a soft, cured silicone polymeric gel, preventing any reflux of the liquid silicone that was injected with a 27-gauge needle through the delivery tube into the balloon.

The implant was sterilized with ethylene oxide gas.

LENS-REFILLING PROCEDURE

Twenty-one lenses in 21 monkeys were refilled with inflatable endocapsular balloons. The monkeys were first anesthetized with an intramuscular injection of ketamine hydrochloride, 5 mg/kg, and xylazine hydrochloride, 2 mg/kg. Ten lenses were refilled with the nonaccommodation balloon and 11 with the accommodation balloon.

The animals were housed at the Yaotsu Breeding Laboratory (Japan EDM Inc, Gifu), where the experiments were performed. The monkeys were treated humanely according to the principles of the Primate Society of Japan.[10]

After maximal mydriasis was obtained with the topical application of tropicamide and phenylephrine hydrochloride, hyaluronate sodium was injected into the anterior chamber and a small, circular capsulorhexis (1.2 to 1.5 mm in diameter) was made with a capsulorhexis forceps (**Figure 3**).

The lens nucleus was then emulsified within the capsular bag using an 0.8-mm endocapsular tip (sleeve diameter, 1.2 mm) (Cooper Vision, Irvine, Calif). The residual cortex was then removed with a thin irrigation aspiration tip that was 0.8 mm in diameter. Heparin sodium, 1000 U, and epinephrine, 0.5 mg, were added to 500 mL of an irrigating balanced salt solution (Alcon Surgical Inc, Fort Worth, Tex) for these procedures.

capsular bag. A mixture of two liquid silicone polymers, polymethyldisiloxane and hydrogenpolysiloxane, which polymerizes in 2 hours in vitro, is then injected into the balloon. The inflated balloon fills the capsular bag. We performed a series of lens-refilling experiments using this inflatable endocapsular balloon in the eyes of young primates to maintain accommodation. Data are given as mean±SD.

RESULTS

Fifteen of 21 lenses could be refilled (**Figure 5**). The failure in six lenses was mainly due to capsule rupture during the operation.

AMPLITUDE OF ACCOMMODATION MEASURED BY AUTOMATED REFRACTOMETRY

In nine of the 15 refilled lenses, automated refractometry was possible. The preoperative and postoperative amplitudes of accommodation of the five lenses refilled with the nonaccommodation balloon and of the four lenses refilled with the accommodation balloon are given in **Table 2**. The amplitude of accommodation decreased markedly after the operation in all eyes, and the small amplitude decreased over time except in monkey 8.

In monkeys 5 and 7, fibrin deposition or capsular fibrosis precluded refractometry at some measurement times.

Ethylenediaminetetraacetic acid (EDTA), 10 μmol/L, dissolved in hyaluronate sodium (Healon, Kabi Pharmacia Ophthalmics AB, Uppsala, Sweden) was injected into the capsular bag after pure hyaluronate was injected into the anterior chamber to protect the corneal endothelium. The EDTA chelates calcium and loosens the junctional complexes of the lens epithelial cells (LECs). After 2 minutes, EDTA-hyaluronate and the loosened LECs in the capsular bag were removed with low-level aspiration.[11] Lens epithelial cells at the 12-o'clock position were removed with a Simcoe (American Surgical Instrument Corp, Westmont, Ill) cannula designed for removal of the cortex at that position.

The balloon with the diameter most closely approximating that of the crystalline lens of the individual monkey in either the nonaccommodated or the accommodated state was selected. After the capsular bag and anterior chamber were filled with hyaluronate, the equator opposite the delivery tube was grasped with Miyake-Simcoe (Inami and Company, Ltd, Tokyo, Japan) lens forceps, and the inflatable balloon was introduced through the 3-mm corneal incision and the small upper capsular opening into the capsular bag (**Figure 4**).

The two liquid silicone polymers of polymethyldisiloxane (the main component) and hydrogenpolysiloxane (a cross-linking agent) were mixed at a 2:1 (vol/vol) ratio. The liquid silicone mixture (Menicon Company, Nagoya, Japan), which polymerizes in 2 hours in vitro, was injected through the delivery tube with an odontologic syringe injector (Citoject, Bayer Dental Nippon, Osaka, Japan) equipped with a 27-gauge needle. The balloons were filled with 0.15 to 0.25 mL of the silicone mixture. After the balloon was filled, the residual air in the balloon was aspirated through the delivery tube using a 32-gauge needle. The delivery tube was then cut at its root. The tube stub containing the cured silicone was left in place within the wall of the balloon to prevent leakage of the liquid silicone mixture.

One percent atropine sulfate ointment was applied in the conjunctival sack at the end of the operation to maintain zonular relaxation when the nonaccommodation balloon was used.

POSTOPERATIVE REFRACTOMETRY

Two weeks, 2 to 3 months, and 6 to 12 months after the operation,changes in refraction were measured in the anesthetized animals with an automated refractometer (Auto-Kerato-Refractometer KR-3100, Topcon Company, Tokyo, Japan) before and 1 hour after topical application of 4% pilocarpine to alter the lens shape. During measurement, the head of the monkey was held to properly position its eye to the refractometer while the monkey was sitting in a special stand. The small ring of the measurement light beam was adjusted to enter within the pupil and the wider light reflex ring on the apparent center of the cornea, which was monitored on a small monitor-equipped television, was adjusted to align with the optical axis. The measurement was undertaken three to five times in each eye and the values were averaged automatically. The spherical equivalence of each value was determined as refraction.

The SD of measurements taken on an eye model (given by the refractometer's manufacturer) was from ±0.10 to ±0.24 diopters.

The refraction in an anesthetized monkey was measured 10 times. The mean (±SD) spherical equivalence and coefficient of variation were −0.33±0.12 diopters and 0.36, respectively.

POSTOPERATIVE MORPHOMETRY

Two weeks after the operation, three morphological features of the anterior segment during accommodation, ie, shallowing of the anterior chamber, increasing of the anterior lens curvature, and thickening of the lens (Figure 1), were measured with the Scheimpflug camera before and 1 hour after topical application of 4% pilocarpine.

HISTOPATHOLOGICAL FINDINGS

One monkey (monkey 6) was killed at 6 months postoperatively by injection of succinylcholine chloride after anesthesia; the lens, which had been refilled with an accommodation balloon, was submitted for histopathological examination.

In monkeys 1, 4, and 7, the amplitude decreased markedly, while capsular fibrosis increased substantially after 3 to 6 months. In the other six lenses, refractometry was not possible owing to fibrin reaction and/or capsular opacification throughout the follow-up period.

MORPHOLOGICAL FINDINGS

The morphological features during accommodation, ie, 1 hour after topical application of 4% pilocarpine, could be confirmed in all 15 eyes. To facilitate comparison, the data are given here for nine eyes in which refractometry was possible.

In the lenses refilled with the nonaccommodation balloon (**Table 3**), the posterior curvature remained almost unchanged, while the anterior curvature was much steeper than that measured under the preoperative condition of the crystalline lens and the original curvature of the balloon after refilling (**Figure 6**). The change in anterior chamber depth and particularly in anterior curvature during accommodation decreased markedly after the operation. The lens thickness was generally greater after refilling, but the change in thickness in accommodation was also markedly decreased.

The morphological changes in the anterior segment in the eyes refilled with the accommodation balloon

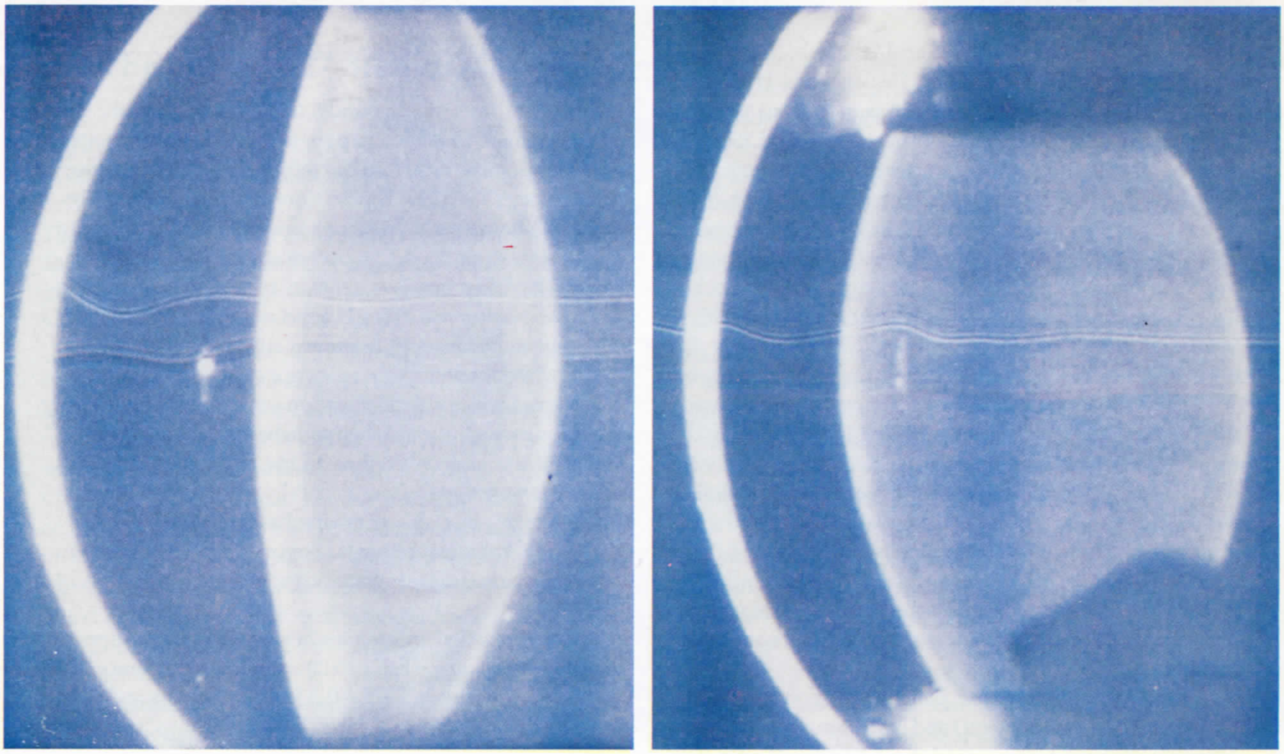

Figure 1. *Scheimpflug camera (Nidek Company, Gamagori, Japan) photograph of a* Macaca fascicularis *monkey lens. Left, Nonaccommodated state, after anesthesia. Right, Accommodated state, 1 hour after topical application of 4% pilocarpine hydrochloride. Note the flattening of the anterior chamber, increase in anterior curvature, and lens thickening during accommodation.*

Table 1. Dimensions of Endocapsular Balloons*

	Diameter, mm	Axial Diameter, mm	Anterior Curvature, mm	Posterior Curvature, mm	Power, D
Nonaccommodation balloon					
1	8.0	3.0	8.5	5.0	21.7
2	8.5	3.0	9.2	5.6	21.7
Accommodation balloon					
1	7.5	3.8	6.0	4.0	28.2
2	8.0	4.0	6.2	4.0	28.2

**Determined when the balloon was inflated by the injection of silicone polymer with the refractive index of 1.403. D indicates diopter.*

(**Table 4**) were similar to those in the eyes refilled with the nonaccommodation balloon. However, the postoperative change in lens thickness during accommodation was less marked than in the eyes refilled with the nonaccommodation balloon.

HISTOPATHOLOGICAL FINDINGS

Gross and histological examination of the eye of monkey 6 revealed slight freckled capsular fibrosis in the periphery and no evidence of the migration of LECs on either the anterior or posterior capsule. However, some cells were present in the equatorial region, where the balloon did not accurately conform to the capsular shape. The capsular bag was well filled (**Figure 7**).

COMMENT

To our knowledge, our report is the first on the measurement of amplitude of accommodation with automated refractometry in experimental lens refilling. Removal of residual LECs by dispersion aspiration as well as the use of an inflatable membrane reduced capsular opacification and inflammation induced by the operation and sufficiently prevented leakage of the filling material to allow refractometry.

Haefliger et al[4] could not accurately measure refraction postoperatively owing to inflammation and capsular opacification. They presumed that full accommodation had been preserved after finding that the decrease in anterior chamber

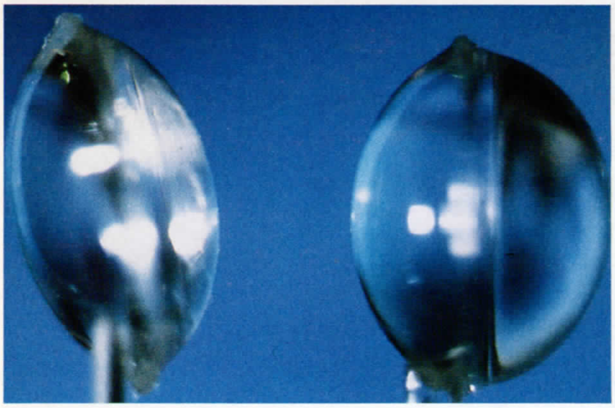

Figure 2. *Inflatable endocapsular balloon refilled with the silicone polymer. The delivery tube is filled with a soft, cured silicone that prevents leakage of the injected material. Left, A balloon approximating the nonaccommodated state of the crystalline lens (equatorial diameter, 8.5 mm). Right, A balloon approximating the accommodated state (equatorial diameter, 7.5 mm).*

Figure 3. *Minicircular capsulorhexis with a diameter of 1.3 mm created with a forceps in a monkey lens. The round, continuous, smooth-edged margin reduces stress concentration so that the capsule will tolerate the strain exerted during the operation.*

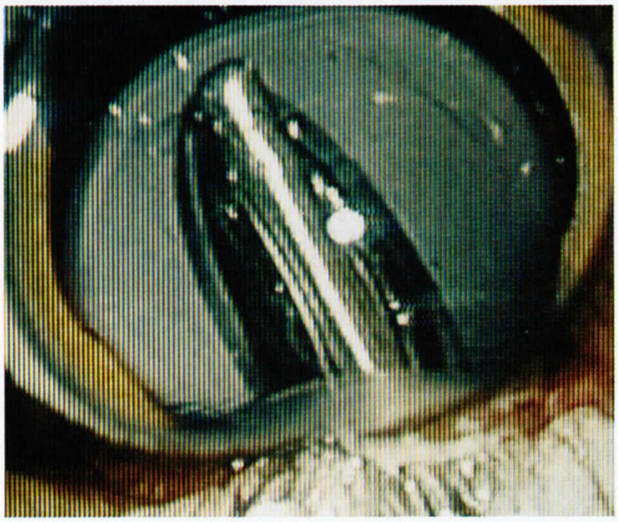

Figure 4. *Insertion of a balloon into the capsular bag. The balloon is rolled like a scroll while it is led through the minirhexis and corneal incision. It usually unfolds as soon as it enters the capsular bag.*

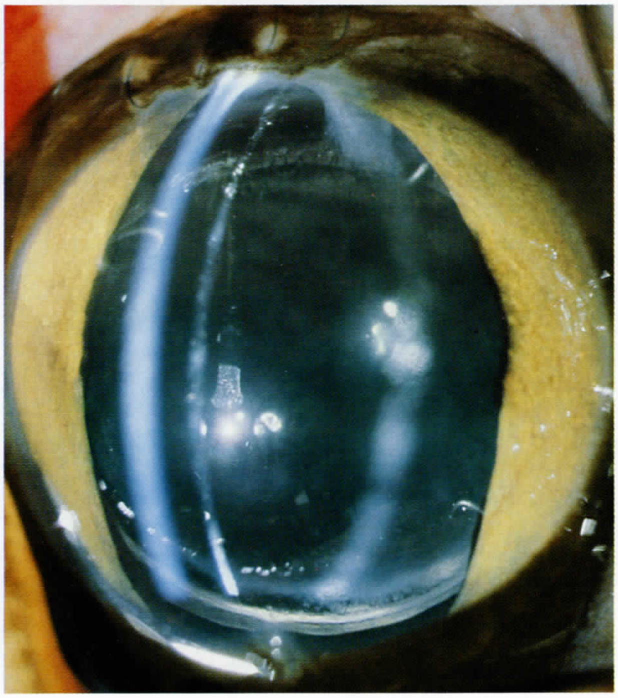

Figure 5. *A monkey eye at 2 months postoperatively. The lens is well refilled with an inflated balloon of the nonaccommodation type.*

depth measured with the Scheimpflug camera was at least as great as with the natural lens following injection of pilocarpine into the anterior chamber. Gindi et al[5] did not describe whether or how they confirmed accommodation.

We developed two types of balloons for our investigation to confirm if the one that approximates the shape of the nonaccommodated crystalline lens yields greater amplitude of accommodation. The investigation was structured on the basis of the recent theory on the mechanism of accommodation[12]: while the lens substance (matrix) in its relaxed state assumes the form determined by its own natural elasticity during accommodation, this state is overridden by the greater elasticity of the capsule, which molds the lens matrix into its accommodated form. The investigation was also based on Fisher's[13] findings that the potential amplitude of accommodation is mainly due to steepening of a flat anterior curvature during accommodation; and, the flatter the lens and the smaller the volume of its anterior segment, the more potential energy is stored in its capsule for release by zonular relaxations.

In our study, the amplitude of accommodation and the changes in lens thickness during accommodation in the lenses refilled with the nonaccommodation balloon were greater than those in the lenses refilled with the accommodation balloon during the entire postoperative period, and these changes were particularly marked by 2 to 3 months postoperatively. This finding is in accordance with Fisher's[13] findings and is also consistent with the recent theory on the mechanism of accommodation.

However, the changes in the anterior segment during accommodation were much less marked after the op-

Table 2. Amplitude of Accommodation in Lenses Refilled With Endocapsular Balloons: Change in Refraction Before and 1 Hour After Topical Application of 4% Pilocarpine*

Monkey No.	Diameter of Balloon Used, mm	Preoperative Change, D	Postoperative Change		
			2 wk	2-3 mo	6-12 mo
Lenses Refilled With a Nonaccommodation Balloon					
1	8.5	15.1	3.6	2.2	0.9
2	8.5	17.1	3.0	2.1	2.4
3	8.0	13.0	2.8	2.0	2.1
4	8.0	15.5	9.0	3.0	1.0
5	8.0	15.3	ND	3.1	2.3
Amplitute, mean±SD	...	15.2±1.3	4.6±2.5	2.5±0.5	1.7±0.7
Lenses Refilled With an Accommodation Balloon					
6	7.5	16.0	1.1	0.5	1.0
7	8.0	14.5	2.3	1.0	ND
8	7.5	22.0	2.4	2.9	3.0
9	8.0	15.5	1.9	0.9	1.3
Amplitute, mean±SD	...	17.0±2.9	1.9±0.5	1.3±0.9	1.8±0.9

*D indicates diopter; ND, not determined for data that could not be obtained owing to fibrin deposition or capsular opacification.

Table 3. Anterior Segment Morphology in the Lenses Refilled With a Nonaccommodation Balloon Before and 1 Hour After Topical Application of 4% Pilocarpine and 2 Weeks After the Operation*

Monkey No.	Anterior Chamber Depth, mm		Change	Lens Thickness, mm		Change	Anterior Curvature, mm		Posterior Curvature, mm	
	Before	After		Before	After		Before	After	Before	After
1										
Preoperative value	3.03	2.37	0.66	3.16	3.59	0.43	9.04	5.35	5.82	5.50
Postoperative value	1.44	1.29	0.15	4.11	4.42	0.31	6.04	5.69	4.19	3.81
2										
Preoperative value	2.91	2.25	0.66	4.42	4.96	0.54	12.81	5.45	5.25	3.58
Postoperative value	2.01	1.84	0.17	2.98	3.28	0.30	5.91	5.60	5.10	4.56
3										
Preoperative value	3.03	2.49	0.54	3.21	4.08	0.87	9.84	4.92	5.23	3.53
Postoperative value	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4										
Preoperative value	3.07	2.49	0.6	3.12	3.75	0.63	9.60	4.94	4.94	3.97
Postoperative value	2.19	1.80	0.39	3.96	4.24	0.28	5.67	5.14	3.90	3.25
5										
Preoperative value	2.92	2.10	0.82	2.84	3.88	1.04	8.95	5.12	4.36	3.77
Postoperative value	2.31	2.15	0.16	4.02	4.30	0.28	5.91	5.12	5.71	4.67
Group value, mean±SD										
Preoperative	2.98±0.07	2.30±0.14	0.69±0.08	3.39±0.61	4.05±0.54	0.66±0.23	10.1±1.58	5.22±0.98	5.09±0.53	4.25±0.76
Postoperative	1.99±0.33	1.77±0.31	0.22±0.10	3.77±0.46	4.06±0.45	0.29±0.01	5.88±0.13	5.39±0.26	4.73±0.72	4.07±0.58

*ND indicates a value that could not be determined because of fibrin deposition and/or capsular fibrosis.

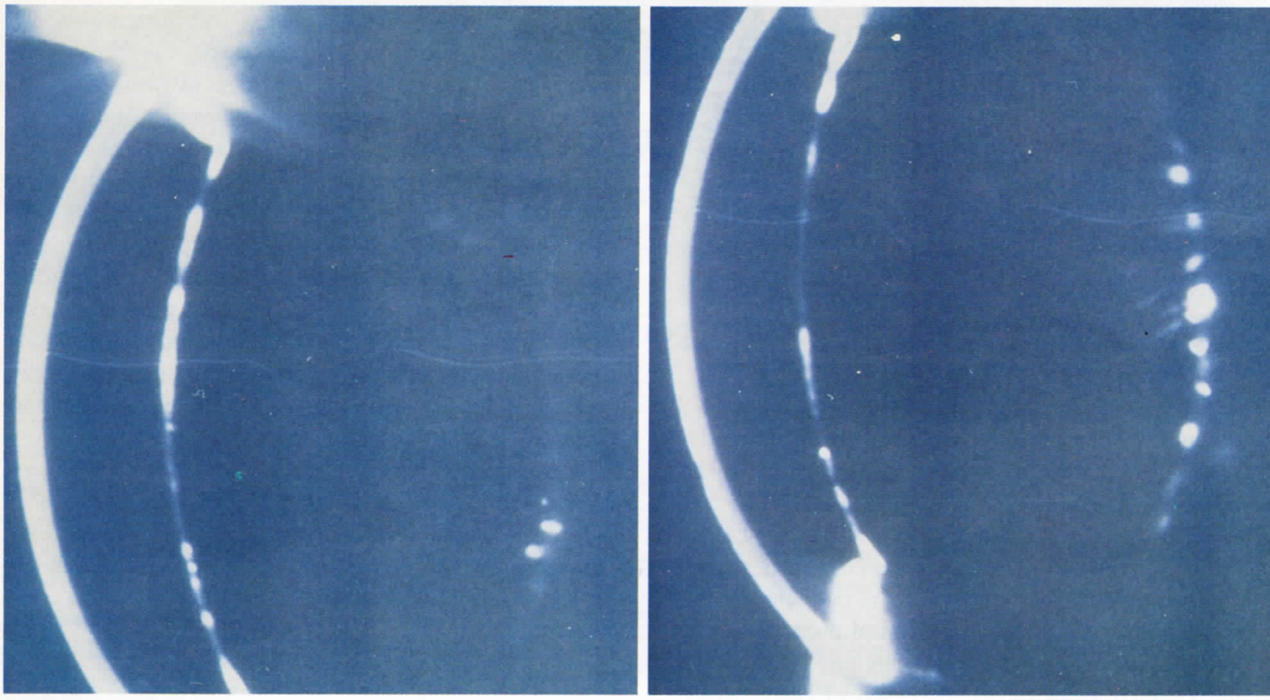

Figure 6. *Postoperative Scheimpflug camera (Nidek Company, Gamagori, Japan) photograph of the eye of monkey 2 refilled with a nonaccommodation balloon. Left, Nonaccommodated state, after anesthesia. Right, Accommodated state, 1 hour after topical application of 4% pilocarpine hydrochloride. A slight shallowing of the anterior chamber and a slight thickening of the axial diameter of the refilled capsule can be seen.*

Table 4. Anterior Segment Morphology in the Lenses Refilled With an Accommodation Balloon Before and 1 Hour After Topical Application of 4% Pilocarpine and 2 Weeks After the Operation*

	Anterior Chamber Depth, mm			Lens Thickness, mm			Anterior Curvature, mm		Posterior Curvature, mm	
Monkey No.	**Before**	**After**	**Change**	**Before**	**After**	**Change**	**Before**	**After**	**Before**	**After**
6										
Preoperative value	2.75	2.31	0.44	2.77	3.59	0.80	10.39	6.74	4.98	3.69
Postoperative value	2.05	1.89	0.16	5.01	5.07	0.06	7.23	6.14	ND	ND
7										
Preoperative value	2.80	2.28	0.52	3.16	3.58	0.42	10.31	5.94	6.13	4.65
Postoperative value	2.20	2.01	0.19	ND	ND	ND	5.35	4.18	ND	ND
8										
Preoperative value	2.82	2.24	0.58	3.17	3.83	0.66	9.59	5.70	6.00	4.14
Postoperative value	1.52	1.28	0.24	ND	ND	ND	5.85	4.75	ND	ND
9										
Preoperative value	2.67	1.92	0.75	3.0	3.69	0.69	9.98	5.57	5.64	3.65
Postoperative value	2.15	1.94	0.21	4.30	4.52	0.22	5.82	5.29	ND	ND
Group value, mean±SD										
Preoperative	2.76±0.06	2.19±0.16	0.57±0.11	3.03±0.16	3.67±0.10	0.64±0.14	10.07±0.32	5.99±0.45	5.69±0.45	4.03±0.41
Postoperative	1.98±0.27	1.78±0.29	0.20±0.03	4.66±0.36	4.80±0.28	0.14±0.08	6.06±0.70	5.09±0.72	ND	ND

**ND indicates a value that could not be determined because of fibrin deposition and/or capsular fibrosis.*

Figure 7. *Histopathological section of the eye of monkey 6 refilled with an accommodation balloon 6 months after the operation. The capsular bag is well refilled. No cell migration is observed on the anterior or posterior capsule.*

eration, and the postoperative amplitude of accommodation was a small fraction of what existed prior to the operation, independently of the type of balloon. The capsular tension was apparently not transmitted effectively enough to the inflated balloon. This ineffectiveness may be due to the discrepancy between the balloon and the lens capsule in size, shape, and physical properties. The properties of the injected homogeneous cured silicone gel also differ from those of the heterogeneous lens mass, which contains an arrangement of numerous lens epithelial fibers. Moreover, the final shape of the refilled capsule is another important factor because it will influence not only the efficient transmission of the capsular tension on the balloon but also the potential amplitude of accommodation.

The final shape of the refilled capsule will be determined by the factors described above, along with the degree of inflation of the balloon. In our animals, the nonaccommodation balloons could not inflate the capsular bag properly to reproduce the original shape of the crystalline lens in the nonaccommodated state and instead conformed to a shape similar to that of the crystalline lens in the accommodated state (Figure 6 and Tables 3 and 4). We think that this result is mainly due to the different properties of the injected silicone compared with the crystalline lens and the inablility to control the filling of the balloon exactly. As a result, the potential amplitude of accommodation stored in the flat anterior curvature of the balloon was lost.

On the basis of our results and considerations, it may be essential to reproduce the nonaccommodated state of a crystalline lens to maintain accommodation in lens refilling. Also, the physical properties of the crystalline lens require more detailed analyses and the development of a silicone elastomer or a novel biomaterial should be investigated in further studies. The literature indicates that the values of many lens parameters do not accurately represent the lens' physical properties and that in reality, very little is known about the human lens.[3] The method of controlling the degree of filling of the lens capsule should also be improved.

The progressive postoperative decrease in amplitude of accommodation we observed may have been caused by capsular fibrosis, which will decrease capsular pliability. The eye of monkey 8, the capsule of which was apparently clear and free of fibrosis, maintained its postoperative amplitude even after 1 year. Although the efficiency of dispersion aspiration was demonstrated to a certain extent, the results, including histopathological findings, indicate the need for further refinement of this technique.

Finally, it is unclear whether useful accommodation can be obtained by refilling the lens of a presbyopic eye, in which the elasticity of the lens mass and the capsule is decreased or lost and the ciliary muscle function[14] is decreased. In future studies, the procedure will be tested in the eyes of aged primates.

A number of surgical difficulties remain to be resolved, but the potential feasibility of refilling the lens with an inflatable endocapsular balloon to maintain accommodation was demonstrated. Our procedure may offer the potential of restoring accommodation after cataract surgery.

Accepted for publication August 19, 1993.

Presented in part at the Symposium on Cataract, Intraocular Lenses, and Refractive Surgery Congress, San Diego, Calif, April 13, 1992.

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Printed and Published in the United States of America