

# Transconjunctival single-plane sclerocorneal incisions versus clear corneal incisions in cataract surgery

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**PURPOSE:** To compare a transconjunctival single-plane sclerocorneal incision with 2 tiny conjunctival cuts at both ends and a clear corneal incision (CCI) in cataract surgery.

**SETTING:** Department of Ophthalmology, Institute of Clinical Medicine, University of Tsukuba, Ibaraki, Japan.

**METHODS:** Patients having routine cataract surgery were randomly divided into 2 groups based on incision type; that is, transconjunctival single-plane sclerocorneal or CCI. The incidence of intraoperative ballooning of the conjunctiva (chemosis) and the percentage of eyes that required stromal hydration to securely close the wound in each group were recorded and compared.

**RESULTS:** Each group comprised 61 eyes (61 patients). No eye in the transconjunctival sclerocorneal group and 6 eyes (9.8%) in the CCI group developed intraoperative conjunctival chemosis ( $P = .027$ , Fisher exact probability test). Corneal stromal hydration was required in 2 eyes (3.3%) and 15 eyes (24.6%), respectively ( $P = .001$ ).

**CONCLUSION:** The transconjunctival single-plane sclerocorneal incision was effective and combined the merits of CCI incisions and sclerocorneal incisions.

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Cataract surgery using a clear corneal incision (CCI) is the technique of choice for many surgeons. In a 2003 survey of members of the American Society of Cataract and Refractive Surgery, 72% of respondents said they used CCIs.<sup>1</sup> Clear corneal incisions are preferred mainly because of the ease of creation, absence of bleeding, and increased accessibility to the anterior chamber through the incision. Concerns exist,

however, about the instability of CCIs in the early postoperative period, the lack of conjunctival coverage over the incision, and a suspected role in postoperative endophthalmitis.<sup>2</sup> Many surgeons still prefer a cataract incision that is covered by the conjunctiva and upper eyelid; that is, the conventional sclerocorneal incision.

To combine the merits of the CCI and the sclerocorneal incision, we developed a new technique in which a transconjunctival single-plane sclerocorneal incision is created with 2 tiny conjunctival cuts at both edges. This study compared the results of the new incision technique with those of the CCI technique.

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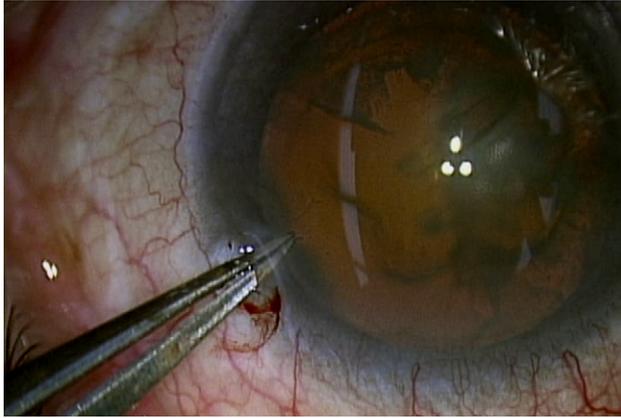
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## PATIENTS AND METHODS

Patients having routine cataract surgery were randomly divided into 2 groups based on incision type; that is, transconjunctival single-plane sclerocorneal or CCI. Patients were selected from consecutive cases in the hospital population who matched the study inclusion criteria. No eye had ocular pathology other than cataract, and no eye had a history of ocular surgery. Videokeratography (TMS-4, Tomey Corp.) and meticulous slitlamp microscopy were



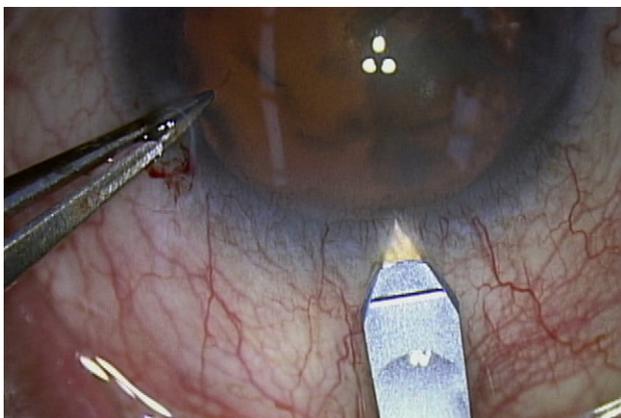
**Figure 1.** The globe is stabilized with a forceps, which pierces the paracentesis, moving the eye slightly downward.

performed before surgery to exclude eyes with corneal disease. The study adhered to the tenets of the Declaration of Helsinki, and all patients provided written informed consent.

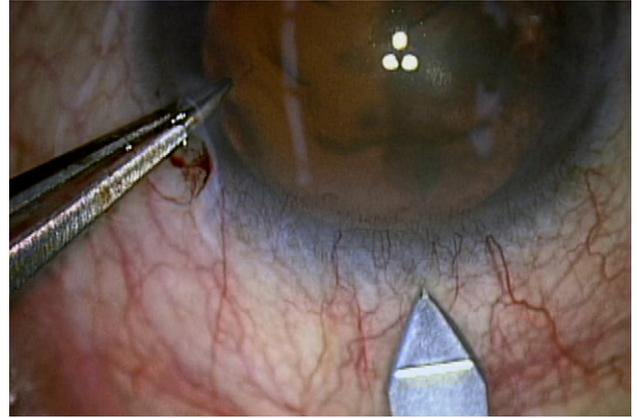
### Surgical Technique

**Both Groups** Except for the incision technique, the surgical procedures were identical in both groups. A 2.4 mm slit knife was used to create an incision in the superotemporal meridian. After a capsulorhexis was created and phacoemulsification was performed, an intraocular lens (AcrySof IQ SN60WF, Alcon, Inc.) was implanted with an injector. Then, the anterior chamber was inflated by injecting a balanced salt solution through the side-port incision. The integrity of the wound was assessed by closely checking for wound leakage and digitally gauging intraocular pressure (IOP). If necessary, corneal stromal hydration was performed.<sup>3</sup>

**Sclerocorneal Incision** The transconjunctival single-plane sclerocorneal incision was created as follows: A paracentesis



**Figure 3.** The knife is moved forward through the conjunctiva, the sclera, and the cornea.



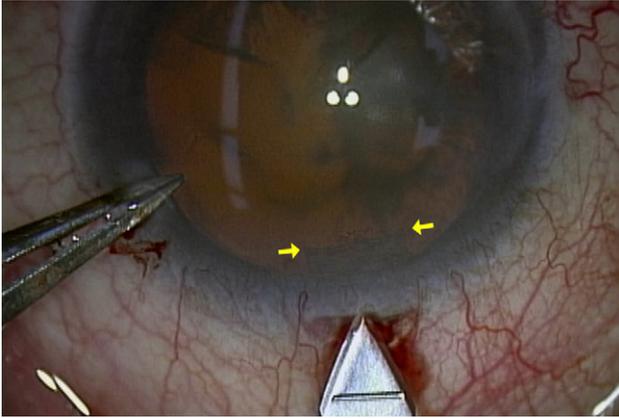
**Figure 2.** A single-plane incision is initiated at the conjunctiva 0.5 mm from the limbus.

was made, and the aqueous humor was replaced with an ophthalmic viscosurgical device. The globe was stabilized using the surgeon's technique of choice, which moved the eye slightly downward. In our series, the globe was fixated by piercing the forceps into the paracentesis (Figure 1). Then, with a steel slit knife, a single-plane incision was initiated at the conjunctiva 0.5 mm from the limbus (Figure 2). The knife was moved forward through the conjunctiva, sclera (Figure 3), and cornea until the horizontal liner mark on the knife surface crossed the external edge of the incision and a square wound configuration was confirmed (Figure 4). Next, the tip of the knife entered the anterior chamber through Descemet membrane. After the tip entered the chamber, the initial plane of the knife was reestablished to cut through Descemet membrane in a straight-line configuration (Figure 5). Care was taken not to direct the slit knife too inferiorly because this could jeopardize the configuration of the inner incision, changing it to a triangular form with the tunnel length shorter toward both sides of the incision (Figure 6).

After the slit knife was removed, small conjunctival incisions approximately 0.5 mm in length were made at



**Figure 4.** The knife is moved in the plane of the cornea until the horizontal liner mark on its surface crosses the external edge of the incision and a square wound configuration is confirmed. Then, the tip of the knife enters the anterior chamber and the initial plane of the knife is reestablished to cut through Descemet membrane.

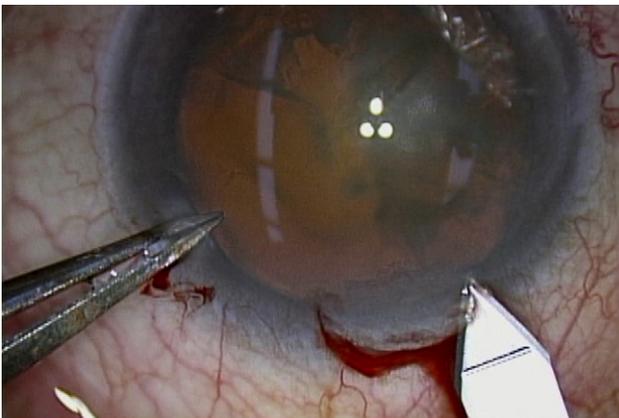


**Figure 5.** The inner incision is made in a straight-line configuration (arrows).

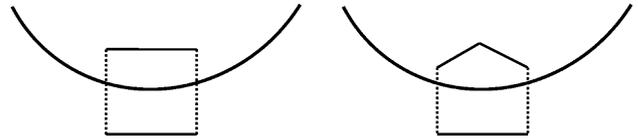
both edges of the wound using the same slit knife (Figure 7) to prevent conjunctival chemosis during surgery. At this point, only the conjunctiva was incised without involving the underlying Tenon capsule. The incisions were extended toward the cornea instead of directed laterally or away from the cornea. The conjunctival cuts can also be made with scissors.

At the end of surgery, the anterior chamber was reformed with balanced salt solution through the paracentesis, aiming for a slightly high IOP to ensure apposition of the internal wound lips (Figure 8).

**Clear Corneal Incision** The CCI was made according to a previously described single-plane incision technique.<sup>4</sup> As in the transconjunctival single-plane sclerocorneal incision, it was confirmed that the horizontal linear mark on the knife surface crossed the external edge of the incision before the tip of the knife entered the anterior chamber and a square



**Figure 7.** Small conjunctival incisions approximately 0.5 mm in length are made at both edges of the wound using the same slit knife to prevent intraoperative conjunctival chemosis. Only the conjunctiva is incised; the underlying Tenon capsule is not involved. The incisions are extended toward the cornea instead of being directed laterally.



**Figure 6.** The incision has to be square with the inner portion in a straight-line configuration (left). If the slit knife is directed too inferiorly, the configuration of the inner incision may be jeopardized, resulting in a shorter tunnel length toward both sides of the incision (right).

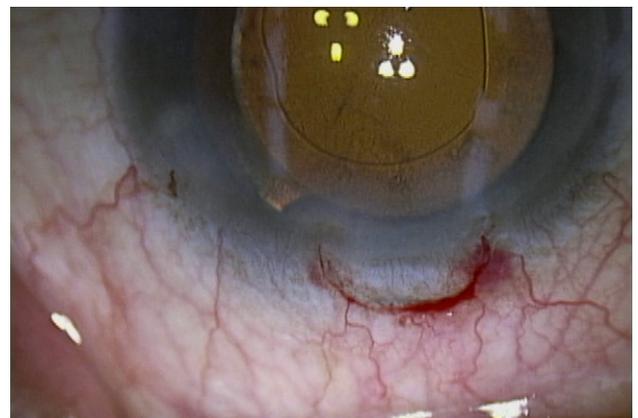
wound was created. After the tip entered the anterior chamber, the initial plane of the knife was reestablished to cut through Descemet membrane in a straight-line configuration.

### Main Outcome Measures

The main outcome measures were the incidence of intraoperative ballooning of the conjunctiva (chemosis) and the percentage of eyes requiring stromal hydration to securely close the wound. The outcomes in the 2 groups were recorded and compared.

### Statistical Analysis

The difference between groups in the incidence of intraoperative conjunctival chemosis and the percentage of eyes requiring stromal hydration was statistically assessed using



**Figure 8.** At the end of surgery, the anterior chamber is reformed with the goal of achieving a slightly high IOP to ensure apposition of the internal wound lips.

the Fisher exact probability test. A *P* value less than 0.05 was considered statistically significant.

## RESULTS

The study included 122 eyes of 122 patients (51 men and 71 women); each incision group comprised 61 eyes.

There were no cases of intraoperative complications in either group. Intraoperative ballooning of the conjunctiva (chemosis) was observed in 6 eyes (9.8%) in the CCI group and no eye in the transconjunctival sclerocorneal group; the difference between groups was statistically significant ( $P = .027$ ). Corneal stromal hydration was required to securely close the incision in 15 eyes (24.6%) in the CCI group and 2 eyes (3.3%) in the transconjunctival sclerocorneal group; the difference between groups was statistically significant ( $P = .001$ ).

On the first postoperative day, there were no cases of ocular hypotony or wound dehiscence in either group.

## DISCUSSION

Intraoperative conjunctival ballooning (chemosis) is occasionally observed during cataract surgery, especially when a CCI is used.<sup>4</sup> When chemosis develops, visualization of the anterior structures of the eye can be compromised. In our study, intraoperative chemosis occurred in 9.8% of eyes in the CCI group; however, no eye with a transconjunctival single-plane sclerocorneal incision had conjunctival ballooning. This result indicates that the small conjunctival incisions made at both edges of the wound effectively prevented the leaking solution from spreading under the conjunctiva. However, this does not mean that intraoperative chemosis never develops with the transconjunctival single-plane sclerocorneal incision. In our experience, moderate conjunctival chemosis has occurred in cases with advanced conjunctivochalasis in the upper conjunctiva. Still, the incidence is low and severe conjunctival ballooning around 360-degree circumferences is rarely seen.

Stromal hydration of the CCI is often performed to help seal the incision.<sup>3,5,6</sup> In the current study, we compared the percentage of eyes that required stromal hydration to attain secure wound sealing. A significantly lower percentage of eyes with a transconjunctival single-plane sclerocorneal incision than in the CCI group required stromal hydration. This result is not surprising because the transconjunctival single-plane incision is a form of sclerocorneal incision, and these incisions do not usually require stromal hydration.

The transconjunctival single-plane sclerocorneal incision has several other advantages. The conjunctival coverage over the wound and the presence of bleeding at the incision facilitate the wound-healing process. This feature, along with our findings, will help prevent postoperative endophthalmitis. The transconjunctival single-plane sclerocorneal technique is simpler than the conventional sclerocorneal method, which entails conjunctival preparation and scleral coagulation. Because there are few opportunities to manipulate the conjunctiva and sclera, there are fewer patient reports of pain or discomfort during surgery. Reports of postoperative discomfort and irritation are also few. Intense bleeding does not occur because of the lack of manipulation to the episcleral tissue, leading to an excellent aesthetic result.

Postoperative wound healing is rapid after surgery using the new incision technique. The apposition and healing of the conjunctival incision occur by the day after surgery, and the wound is not readily visible within a few days. There is no scar formation because coagulation or suturing of the incision is not performed. Because Tenon capsule remains almost intact and there is no conjunctival scarring, future filtering surgery can be performed without difficulty.

Although we placed the incision at the superotemporal meridian, the transscleral single-plane incision can be made superiorly or temporally. If necessary, the incision can be easily extended without inducing wound instability, which points to the flexibility of this incision technique compared with the CCI method. In addition, unlike a CCI, the transconjunctival single-plane incision resumes its shape after being stretched. The intraoperative maneuverability through the transconjunctival single-plane incision is the same as through a CCI and better than through a conventional sclerocorneal incision.

In 1996, Ernest and Neuhann<sup>7</sup> reported a posterior limbal incision technique, in which they placed a vertical conjunctival and scleral cut at the limbus using a crescent blade in the inverted position. The incision began at the posterior limbus to reduce ballooning of the conjunctiva. They stated that attempting to begin the incision in sclera, behind the posterior limbus, increases the risk for conjunctival ballooning. Our incision starts more posterior than their incision; therefore, we added 2 tiny conjunctival incisions at both ends of the wound to prevent conjunctival chemosis. This is the unique aspect of our technique. In 2000, Tsuneoka and Takahashi<sup>8</sup> reported a technique called scleral corneal 1-plane incision cataract surgery. However, conjunctival peritomy and scleral cautery for hemostasis were applied before the sclerocorneal incision was created. In 2000, Buzard and Febraro<sup>9</sup> described a transconjunctival corneoscleral tunnel

“blue-line” cataract incision technique. They made a miniperitomy 1.5 to 2.0 mm behind the surgical limbus before creating a sclerocorneal tunnel incision. These 3 previous incision techniques use conjunctival peritomy and are not actually a transconjunctival single-plane incision.

The current study has several limitations. First, we tested only 2.4 mm incisions and thus the current results may not apply to other incision sizes. The percentage of eyes that required stromal hydration, however, was not extremely high. Second, detailed assessment of postoperative data, such as optical quality of the cornea, intensity of postoperative anterior chamber inflammation, and incidence of postoperative cystoid macular edema, was not performed. These will be evaluated in future studies. Third, meticulous assessment of wound integrity was not performed, as in a study by Vasavada et al.<sup>5</sup> in which trypan blue was used as a quantifiable ingress tracer to determine whether stromal hydration reduces ocular surface fluid ingress into the anterior chamber. Interesting results might be obtained by using such methodology.

In conclusion, we compared CCIs and transconjunctival single-plane incisions in terms of the rate of chemosis and necessity of stromal hydration. We found that the incidence of intraoperative conjunctival ballooning and the percentage of eyes that required stromal hydration were significantly lower in the transconjunctival single-plane sclerocorneal incision. We believe this is an effective incision technique that combines the advantages of the CCI and the conventional sclerocorneal incision.

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