

Tip Position during Phaco



Dear Editor:

Since the introduction of phacoemulsification as a technique to remove cataracts, endothelial cell loss has been a major concern of surgeons. During phacoemulsification, mechanical factors related to fragmentation of lens material are unavoidable. Direct mechanical cutting (jackhammer effect) and implosion of microcavitation bubbles produce brief instances of extreme heat and pressure.¹ The causes of endothelial injury have been related to these mechanical effects of ultrasound, movements of lens fragments and air bubbles, high fluid turbulence in the anterior chamber, and as reactive oxygen species.²

In most phacoemulsification techniques, ultrasound energy is directed at the corneal endothelium (CE) because of the bevel-up tip position. The direction of the energy load could be an important reason for cell loss. The few authors who have described variations in the position of the phacoemulsification tip have suggested that the bevel facing down would cause less turbulence of lens fragments and a better contact between cataract tissue and the phaco tip.^{3,4} In addition, this technique variation may prevent CE damage, improving the efficacy of the procedure. Although these studies showed significant differences regarding endothelial cell loss, the effect of bevel position as an isolated factor was not studied. Changes in both bevel position and in other surgical details were used, and their effects on CE may have been attributable to any of these factors. Although bevel-down techniques already have been reported, there is no well-controlled study comparing the effect of bevel tip position on the CE and other surgical parameters. We are aware of only 1 study that used an artificial model and did not detect any effect of bevel position on the CE. However, the experimental situation was completely different from a real surgical situation.⁵

We evaluated 25 consecutive patients ranging in age from 42 to 84 years (mean \pm standard deviation, 64.7 ± 12.5 years) with 50 bilateral and symmetric senile cataracts. The position of the bevel tip in the first eye operated on was randomized for each patient. For the second eye of the same patient, the position of the tip was necessarily the opposite one. Thus, 2 groups of eyes paired according to bevel tip position were obtained for the 25 patients: group 1, bevel up; and group 2, bevel down.

The follow-up period was 3 months. Specular microscopy was performed before surgery and 1 and 3 months after surgery. Effective ultrasound time, total surgical time, and complications also were recorded.

Statistical analysis of changes in endothelial cell count between the preoperative and postoperative period was performed by a 1-way analysis of variance for repeated measures with post hoc analysis with the Tukey test. For the

other parameters, a paired *t* test was used. Data are presented as mean \pm standard deviation, with the level of significance set at $P < 0.05$.

The paired *t* test revealed no statistical differences between groups for mean effective ultrasound time (group 1, 8.08 ± 6.75 seconds; group 2, 7.00 ± 5.75 seconds) or mean total surgical time (group 1, 10.01 ± 2.46 minutes; group 2, 9.86 ± 2.17 minutes). Complications also were quite similar between groups (Table 1, available at <http://aaojournal.org>). Mean CE cell loss was 6.9% in group 1 and 3.6% in group 2 at 3 months after surgery (Fig 1, available at <http://aaojournal.org>). Comparison of endothelial cell count by the Tukey test showed statistically significant differences between groups during the postoperative period (Table 2, available at <http://aaojournal.org>).

The present study showed a significantly greater endothelial cell count loss in phacoemulsification with the conventional bevel-up tip position when compared with the results using the bevel-down tip position. Moreover, we believe that the bevel-down position is an easier technique that can facilitate the attachment of the lens fragments. The safety of this approach may be an important concern. A posterior direction of the ultrasound wave may rupture the posterior capsule and dislocate pieces of the nucleus to the vitreous cavity. However, with this technique, the epinucleus may act as a barrier, preventing these complications. Our data support this hypothesis, because we did not observe differences in complications between these 2 approaches.

Because other surgical parameters showed similar findings, we conclude that both techniques may be used, according to the surgeon preference. Because bevel-down tip position had fewer negative effects on the corneal endothelium, it should be considered as a safe option in noncomplicated phacoemulsification.

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Table 1. Intraoperative and Postoperative Complications

Complication	Group 1	Group 2
Posterior capsule rupture	1	0
Exacerbated postoperative inflammation	0	1
Transitory macular edema	1	1
Posterior capsule opacification	6	6

Table 2. Mean Values of Endothelial Cell Count

Technique	Before Surgery	1 Month after Surgery	3 Months after Surgery
Bevel up	2554.48	2378.39	2378.41
Bevel down	2589.76	2516.47	2496.94
F test	0.72 (NS)	5.52*	12.66*
P value	0.4035	0.0319	0.0026

NS = not significant.
*Statistically significant.

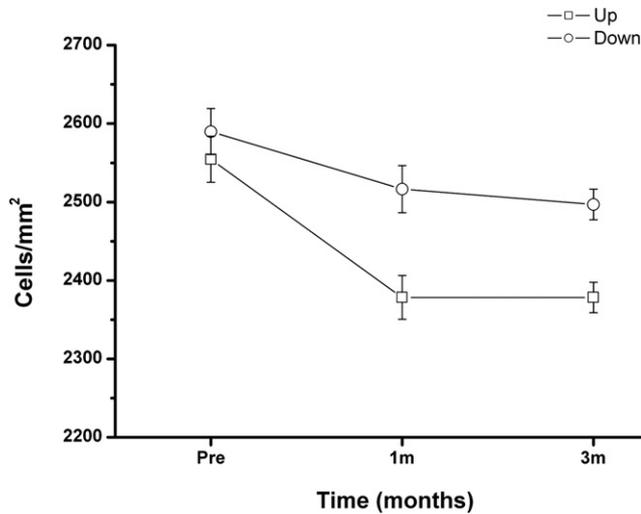


Figure 1. Mean CE cell loss.