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SURGICAL TECHNIQUE

Phacoemulsification using a chisel-shaped illuminator: enhanced depth trench, one-shot crack, and phaco cut

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ABSTRACT

Purpose: To evaluate the efficacy and outcomes of intracameral illuminator-assisted nucleofractis technique in cataract surgery.

Methods: Since June 2012, this novel technique has been performed in all cataract cases by one surgeon (approximately 300 cases of various densities). Trenching continues until the posterior plate white reflex between an endonucleus and an epinucleus is identified (enhanced depth trench). After trenching, cracking is initiated with minimal separation force, and completion of cracking is confirmed by posterior capsule reflex (one-shot crack). With followability enhanced by an elliptical phaco mode, the divided nucleus is efficiently cut into small fragments by a chisel-shaped illuminator (phaco cut).

Results: We have not experienced any capsular bag or zonular complications, and the effective phacoemulsification time seemed to be shorter than that with the conventional technique.

Conclusions: This technique simplifies the complete division of the nucleus, which is the most challenging step in safe and efficient phacoemulsification.

Keywords: Chisel-shaped illuminator, Enhanced depth trench, One-shot crack, Phaco cut

Introduction

An advanced cataract surgery technique using intracameral illumination has been introduced with real-time, 3D, high-quality lens images (1-3). We describe a chisel-shaped illuminator-guided phacoemulsification nucleofractis technique: enhanced depth trench, one-shot crack, and phaco cut. The trenching and cracking were optimized under observation and precise control, and cracked nuclei were efficiently split just with the chisel, even without second instruments such as a chopper.

Surgical technique

A 3.0-mm clear corneal wound for the phacoemulsification handpiece and a 0.7-mm side port wound for the illuminator were created at the 9 o'clock and 2 o'clock positions, respectively. In the bevel-down position, the illuminator tip enters the anterior chamber, and is maintained to prevent glare (Figs. 1, A1 and A2). Capsulorhexis of the anterior capsule was done with its margin covering the edge of a 6.0-mm optic intraocular lens. After hydrodissection and hydrodelineation, the phaco tip was inserted into the anterior chamber. Then, a running 23-G illuminator was introduced into the anterior chamber through the side port, and the microscope light was extinguished.

Using standard settings for elliptical sculpting, trenching was performed within the capsulorhexis edge at the geometric center of the endonucleus. A 30-degree Kelman (Lisburn, UK) phaco tip was used, enabling the surgeon to trench deeply without stressing the subincisional capsular bag and zonules. Following a 50% to 60% deep vertical trenching, the illuminator was placed in the trench to evaluate its exact depth, and the enhanced depth trench was created bit by bit with cautious shallow sculpting until the posterior plate of the nucleus was identified (posterior plate white reflex) (Figs. 1, B1 and B2). The posterior plate white reflex was the endpoint of trenching, and the cracking was initiated using the illuminator tip and phaco tip positioned parallel to each other in the deep walls of the trench. The nucleus was completely divided into 2 hemispheres with minimal lateral separation force, and the posterior capsule was visible under the intracameral illumination. The posterior capsule reflex indicates that the cracking was completed, ensuring that no fibers remained attached (Figs. 1, C1 and C2). Segment removal was then performed using standard settings for elliptical quadrant removal. Each half of the bisected nucleus was rotated slightly to the inferior capsular bag, captured by the phaco tip, drawn to the midpupillary area, and

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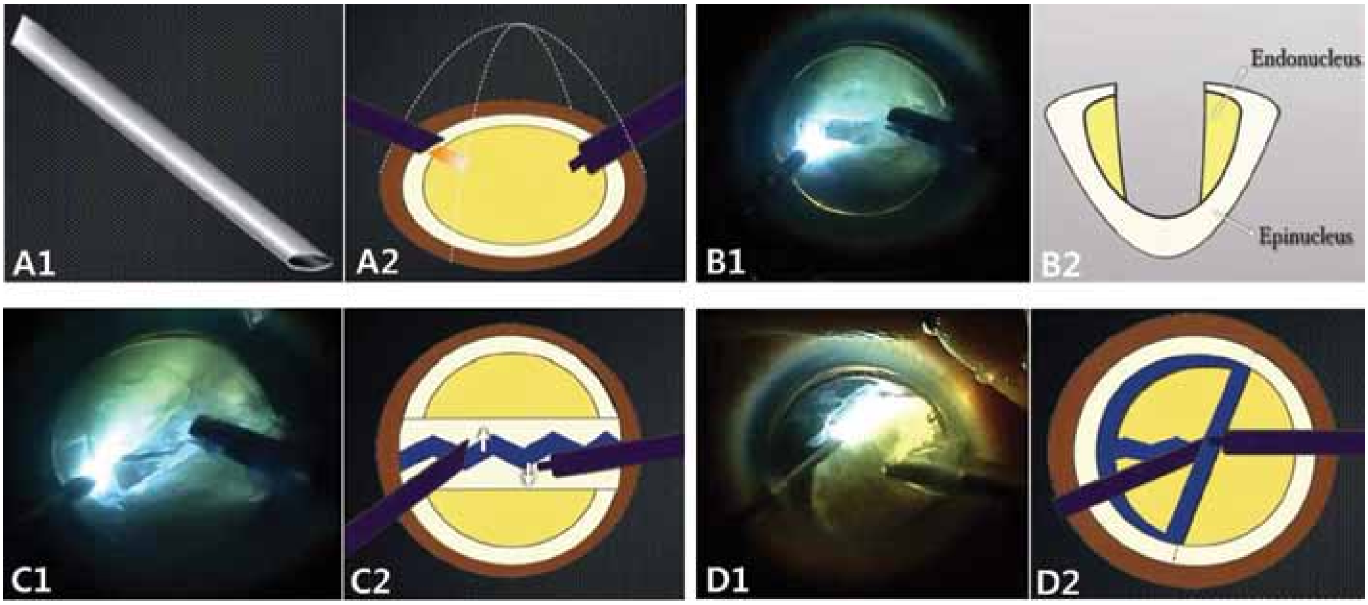

Fig. 1 - (**A**) Chisel-shaped illuminator. A chisel-shaped cutting tip of the illuminator (**A1**) makes it easy to cut the fragments of the nucleus. In the bevel-down position, the illuminator tip is maintained to prevent glare (**A2**). (**B**) Enhanced depth trench. Photographs (**B1**) and schematics (**B2**) show posterior nuclear plate white reflex in contrast to endonucleus yellow core. (**C**) One-shot crack. Photographs (**C1**) and schematics (**C2**) show a bare central posterior capsule (posterior capsule reflex) and a complete crack in the posterior nuclear plate, created by one cracking. (**D**) Phaco cut. Photographs (**D1**) and schematics (**D2**) show that the divided nucleus hemisphere is pulled to the pupil center with the phaco tip using an elliptical quadrant removal setting, and the nucleus is then split by the chisel-shaped illuminator tip, moving toward the phaco tip.

cut by the chisel-shaped illuminator tip, moving toward the phaco tip (Figs. 1, D1 and D2). Then, the cut nucleus fragments were stuffed or emulsified into the phacoemulsification probe. Throughout the procedure, the phaco tip and the illuminator remained within the capsulorhexis margin. All surgical steps illustrated in figures are played back on video (Supplementary Video, available online at www.eur-j-ophthalmol.com).

Discussion

This novel nucleofractis technique offers several advantages over conventional nucleofractis techniques. First, a form of trenching and cracking is simplified and phased under outstanding view and exquisite control. It minimizes mechanical stress to the capsule and zonules. Second, it reduces rotation of the nucleus within the capsular bag, and all the work is done within the capsulorhexis margin. It preserves the integrity of the capsular bag and zonules. Third, it eliminates corneal scatter and reflection by the operating microscope light and provides excellent visibility of the lens structures. Finally, there might be less macular phototoxicity caused by intracameral horizontal illumination than coaxial microscope direct illumination (1, 2, 4-6).

Disclosures

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