Efficacy of Torsional Phaco in Hard Egyptian Cataract Versus Combined Torsional and Longitudinal Phaco Using the Infiniti Vision System

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Abstract

**Purpose:** To compare the efficacy and phacoemulsification parameters of torsional mode versus the combined torsional and longitudinal ultrasound mode in hard cataract of Egyptian patients.

**Methods:** This randomized comparative study evaluated eyes 1, 7, and 30 days after phacoemulsification with an Infiniti Vision System using the torsional mode versus the combined torsional (100%) and longitudinal ultrasound (US) mode (20%). Egyptian patients with nucleus grade ranging from NO4/NC4 to NO5/NC5 were selected. Nucleus fragmentation was done by the stop and chop method. Primary outcome measures were phaco time, mean phaco power, mean torsional amplitude, amount of infused fluid, cumulative dissipated energy (CDE) and total energy.

**Results:** 42 eyes of 42 patients divided randomly into two groups were evaluated. There is no statistical difference between the torsional mode and the combined torsional and longitudinal ultrasound (US) mode as regarding the phacoemulsification parameters, although they were lower in the combined mode. No complications were recorded among both groups.

**Conclusions:** Torsional mode alone can be used for emulsification of very hard cataract with no added risks or complications.

**Key Words:** Torsional mode – Longitudinal mode– Infiniti system.

Introduction

**MANY** innovations and improvements in phacoemulsification have occurred in the past 20 years, allowing options tailored to different degrees of nucleus density. Although ultrasound previously was used only in continuous mode, ultrasonic energy can now be fixed-continuous; linear-continuous or modulated in pulse shape, burst, microburst, micropulse, or hyperpulse [1-4,7-9].

Torsional technology is a new modality of phaco that offers advantages over other modalities.

The transition from longitudinal movement (40kHz) to side-to-side movement (32kHz) of the Kelman phaco tip has made ultrasound more efficient and productive with lower parameters [5].

Torsional phacoemulsification decreases frictional heat generation and minimizes repulsion of nuclear material to decrease fluid turbulence and improve cutting ability, resulting in an overall improvement in the safety and efficiency of lens removal [6].

The Kelman Mini-Flared 45° phaco tip (Alcon Laboratories, Inc.) significantly reduces the rate of clogging in very hard cataracts. This tip together with the advanced fluidics of the Infiniti platform are contributing to the energy efficiency of torsional phacoemulsification [5,6].

It has been also suggested that combining torsional and longitudinal modes could be more efficient in dense cataract removal with less rate of tip clogging [6].

The idea to compare torsional US with a combination of longitudinal and torsional US was taken from the observation that the phaco tip was sometimes occluded during hard cataract removal.

**Material and Methods**

This is a randomized comparative study in which patients with a diagnosis of senile cataract were randomly assigned into two groups; group A in which torsional phacoemulsification was used and group B in which combined longitudinal and torsional phacoemulsification were used.
Inclusion criteria included patients 50 years and older with anterior chamber depth >2.4mm and a dilated pupil >7mm. Exclusion criteria included eyes with pseudoexfoliation, traumatic, or complicated cataracts, history of previous intraocular surgery, glaucoma, uveitis, and patients who were unable to comply with follow-up examinations.

Standard preoperative examinations were performed. The grading of cataracts was determined according to the Lens Opacities Classification System II [10]. Cataracts ranging from NO4/NC4 to NO5/NC5 were included. All surgeries were performed using the Infiniti Vision System (Alcon Laboratories), and the same US and fluidic settings were used by a single experienced surgeon.

42 eyes of 42 patients were included in this study and randomly assigned to one of the two groups: 100% Fixed Torsional amplitude (Group A) and linear Torsional in conjunction with the longitudinal ultrasound energy (Group B).

After informed consent was obtained, all patients received local anesthesia either retrobulbar or peribulbar prior to surgery. A 3mm self-sealing clear corneal incision was made and a solution of sodium hyaluronate 3.0% and chondroitin sulfate 4.0% (Viscoat) was used in the surgery. A routine stop and chop technique was used in both groups. The microtip 0.9mm angled Aspiration Bypass System phaco tip (45 degrees) was used with a standard setting. For group A; the torsional mode was fixed 100% in amplitude. For group B the patients were operated using 100% torsional amplitude and 20% traditional longitudinal ultrasound.

The vacuum limit was 400mmHg, and the aspiration flow rate was 35mL/min, zero dynamic rise and 100cm bottle height. An intraocular lens was inserted with the injector through the main incision wound into the capsular bag. No sutures were performed on the clear corneal wound.

The main system parameters were mean US time (UST), cumulative dissipated energy (CDE), and the amount of irrigating fluid utilized which were automatically calculated by the device. US time represents the total time in seconds that U/S (or OZil) remained active.

CDE correlates to the total amount of energy at the incision. CDE is calculated as follows for Phaco: CDE=average U/S power × U/S time. In Torsional mode, the CDE was calculated as: Torsional amplitude × Torsional time × 0.4. The frequency of the phaco tip in Torsional mode was 80% of the standard phaco (32kHz in Torsional versus 40kHz in Phaco), and the travel distance of phaco tip in Torsional mode was half that in standard phaco. This helped justify setting the coefficient to 0.4.

After the surgery, gatifloxacin and prednisolone acetate eye drops four times a day for two weeks were prescribed. Patients were examined on postoperative days 1, 7, and 30. The postoperative best corrected visual acuity (BCVA), central corneal edema and other complications were documented.

Statistical analysis was performed using SPSS ver. 12.0 (SPSS Inc., Chicago, IL, USA). Comparisons between the two groups were performed using independent t-test. A p<0.05 was considered statistically significant.

Results

A total of 42 eyes (42 patients), 21 in group A and 21 in group B were enrolled in the study. The mean age of all patients was 63.0±7.2 years. The mean age of patients in the group A and B were 63.8±8.8 years and 64.3±7.4 years respectively. Twenty seven patients were male and 14 were female.

The mean UST (45.94±9.1 in group A, 45.91±10.0 in group B; p=0.729), CDE (15.07±1.64 in group A, 14.98±1.35 in group B; p=0.691), and the irrigating fluid amount (145.5±17.0 in the group A, 147.8±31.6 group B; p=0.762).

In both groups, best-corrected visual acuities at one month postoperative exam were 0.94±0.22 decimals in group A and 1.0±0.12 decimals in the group B the difference was not statistically significant. (p>0.05).

The frequency of central corneal edema and Descemet’s striae, although was slightly higher in group A (4 cases), than in group B (3 cases), but statistically insignificant (p>0.05).

Discussion

The aim of the recent phacoemulsification research is to reduce phaco energy and shorten the phaco time so that the risk of ultrasound induced endothelial cell loss should be minimized. Numerous surgical methods and phaco technologies have been designed to accomplish that [11-17].

Recently, many authors have suggested a better efficiency by the torsional mode rather than longitudinal mode. These studies demonstrated that
the angled tip/torsional US combination reduced tip travel by more than 40% compared with the straight tip/longitudinal US. Also the side-to-side stroke has a cutting effect, which induces no repulsion. All these factors imply increased nuclear followability, fewer reacquisition movements, and increased phacoemulsification efficiency and safety [18].

However, there have been debates about the comparative efficacy and safety of torsional mode US in hard nucleus cataracts, as compared to longitudinal mode due to clogging of the phaco tip [19].

This led to the hypothesis that adding longitudinal ultrasound to torsional mode makes the latter more efficient with less tip clogging [20]. Ozil Torsional Technology provides the flexibility of being used alone or in combination with different levels of standard high-frequency Ultrasound energy for different lens densities.

The purpose of this study was to evaluate the efficiency of Torsional with or without longitudinal ultrasound power in handling a hard nucleus.

In group A, torsional amplitude was fixed at 100%, which means that the Torsional amplitude reached 100% once the pedal was in the third position. While in group B 100% torsional amplitude was combined with 20% of longitudinal ultrasound.

Our results show that Torsional combined with ultrasound power and fixed torsional amplitude are both effective and safe for hard nucleus extraction, however adding longitudinal power to torsional mode made the surgery smoother with less tip clogging in hard cataract [20-22].

Liu, et al. demonstrated UST of 48.39 and CDE of 14.08 for grade IV nuclear cataract [20], while Awadalla demonstrated 44.7 and 15.3 respectively for the same grade [21]. The results of the current study demonstrated similar figures; however it didn’t include other modalities of torsional power or other nuclear densities.

Both groups showed similar results as regarding visual acuities at the end of 30 days postoperative, and this was similar to what was found by Zeng, et al. in the ultrasound group and the mixed torsional and ultrasound group [22].

Although the amount of irrigation fluid used (a potential cause of corneal endothelial cell loss) was higher in group B than group A; however it was statistically non-significant. This is similar to Khium findings of lower amount of irrigating fluid used in torsional mode as compared to longitudinal mode [23].

References


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