

Comparison Study between Ultra-Chopper and Divide & Conquer Techniques

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How to cite this paper: Hida, W.T., de Medeiros, A.L., Tzelikis, P., Nakano, C.T., Carricondo, A.F.P.M.P., Barboza, M.C., Vilar, C. and Nose, W. (2022) Comparison Study between Ultra-Chopper and Divide & Conquer Techniques. *Open Journal of Ophthalmology*, 12, 201-207.

<https://doi.org/10.4236/ojoph.2022.122019>

Received: March 14, 2022

Accepted: May 22, 2022

Published: May 25, 2022

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Abstract

Background: Hard brunescient nuclei are difficult to chop with traditional techniques, because leathery tough strands may connect the posterior surface and span across the fragments, which poses a challenge to completely divide the nuclei. The ultra-chopping technique was designed to mitigate this issue.

Purpose: To compare the intraoperative parameters between Ultra-Chopper and Divide & Conquer Techniques. **Setting:** This study was performed at Hospital Oftalmológico de Brasília, Brasília, DF, Brazil. **Patients and Methods:** A prospective, randomized and comparative study. Patients with the diagnosis of dense cataract and surgical extraction programmed were divided into two groups: Ultra-Chopper and Divide & Conquer. Intraoperative data were collected and submitted for the statistical analysis. **Results:** 36 eyes were included, 19 eyes with Ultra-Chopper and 17 eyes with Divide & Conquer. Groups were statistically equivalent in age and nucleus density. There were no surgical complications. Torsional time and cumulative dissipated energy were significantly reduced in the ultra-chopper group. The ultra-chopper group had less total case time, fluid usage and aspiration (ASP) time. **Conclusion:** The ultra-chopper technique can reduce ultrasound energy dissipation during cataract surgery, and decrease case time, fluid usage and ASP time.

Keywords

Ultra-Chopper, Cataract, Aspiration

1. Introduction

Preserving the corneal endothelium during phacoemulsification has been well established as a factor in the recovery from intraocular surgery edema [1] [2]. As

a rule, cataract surgeons always target visual recovery following surgery, so patients may resume their routine activities. Microincision cataract surgery induces less corneal edema providing a prompt visual recovery. The principal causes of corneal edema after cataract surgery are the thermal and mechanical energy dissipated by ultrasonic vibration of the tip and the turbulent flow of Balanced Saline Solution (BSS) and cataract particles striking the endothelium [3]. In order to diminish corneal injury, some surgical techniques have been developed, such as “nuclear pre-fracture” and “bevel-down technique” decreasing endothelial damage by reducing the ultrasound energy dissipated by the phacoemulsification tip [4] [5] [6] [7] [8].

Several phacoemulsification strategies aimed to reduce the dispersion of energy, such as the Torsional Ozil[®] systems (Alcon Laboratories, Ft. Worth, TX), and new tips with different designs were developed.

Improvements in machine technologies and surgeons’ effective usage of these devices are important to obtain satisfactory visual outcomes after cataract surgery, especially in more dense cataracts.

Divide & Conquer is an established method for the emulsification of cataracts and ultra-chopper is a method in which there is a special phaco tip to cut the nucleus in brunescant cataracts with less stress on the zonules and capsula bag. The lens desing was assembled by Dr. Luis Escaf, and the idea came when he was using an electric knife at home.

To our knowledge, this is the first published study that aims to compare intra-operative parameters of two different techniques: the Ultra-Chopper and the Divide & Conquer.

2. Materials and Methods

This was a prospective, comparative, randomized, patient-masked study. Consecutive cataract cases were assigned to Ultra-chopper or Divide and Conquer technique. Randomization was 1:1 for both techniques. Patients were enrolled in this study if they had very hard, brunescant nuclei.

The study was performed according to established ethical standards for clinical research of the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of the University of Sao Paulo in Brazil. The study was conducted between November 2011 and February 2012 [9].

The examiner conducting postoperative evaluation of visual outcomes did not have access to the patients’ medical records. This study enrolled 36 eyes of 36 patients, 16 women and 20 men. Mean age of subjects was 62.54 years, the Standard Deviation (SD) was 5.81 (ranging from 45 to 85 years).

There were no intra-operative complications. We used the LOCS III system to grade the cataracts [10]. There was no statistical significance comparing nuclear density between groups. When separating the soft and hard cataract data.

All surgeries were performed by the same surgeon (WTH), with the following description: topical anesthesia with lidocaine 0.5%, 2.2 mm clear corneal incision

on the steepest meridian axis. Injection of cohesive and dispersive viscoelastic with soft-shell technique in the anterior chamber, and continuous curvilinear capsulorhexis [11] followed by hydrodissection, which was achieved with a solution of 1% non-preserved lidocaine in balanced salt solution [12]. Cataracts were emulsified by conventional phacoemulsification with Infiniti Ozil Vision System (Alcon Laboratories, Fort Worth, TX, USA) and bevel-down technique [13] [14]. After cortical aspiration, the IOL was placed in the bag with Royale® (Asico, Chicago, CA, USA) or Emerald® (J&J Vision, Santa Ana, CA, USA) delivery systems and were carefully centered afterwards. The same phacoemulsification settings were used for all surgeries as follows: torsional ultrasound at 20 pulse per second (minimum amplitude of 20%, maximum 80% and time on 85%), longitudinal power was zero, irrigation bottle height was 100 cmH₂O, vacuum was linear (minimum 70 and maximum 350 mmHg), dynamic rise zero, aspiration flow rate 30 cc/min, and Ozil IP settings 1.0, with 10 ms and 95% power. Intra-operative measurements included total, torsional, phaco, case and aspiration time, infusion fluid used and cumulative dissipated energy (CDE). The total CDE is the average percentage of power spent during US and is calculated in torsional mode as: average torsional amplitude × torsional time × 0.4. The CDE was calculated and displayed on the monitor of the phaco machine automatically [5] [15]. The statistical analysis of the results was performed by Statistical Program for Social Sciences (SPSS, Inc.) version 17.0, with the Excel XP program (Microsoft Com.) and Statistica (version 5.1.), the analysis was performed by One-way Analysis of Variance (ANOVA) and Tukey-Kramer Multiple Comparisons Test. Differences were considered statistically significant when the P value was less than 0.05.

3. Results

A total of 40 subjects (40 eyes) were enrolled into the study. There were 4 eyes who discontinued after randomization were due to meeting exclusion criteria or failing to meet inclusion criteria (lost to follow-up, n = 4). A total of 36 subjects (36 eyes) were included in the all-implanted and safety analysis sets. There was no statistical significance in age between the two groups (Divide & Conquer 75.76 ± 6.64; Ultra-Chopper 71.74 ± 6.54; p > 0.05). There were no surgical complications. We used the LOCS III system to grade the cataracts. There was no statistical significance of nuclear density between groups (Divide & Conquer 3.56 ± 0.70; Ultra-Chopper 3.84 ± 0.74; p > 0.05). There were no intra-operative complications. We used the LOCS III system to grade the cataracts. There was no statistically difference of nuclear density between the groups. Comparing the aspiration time and fluidics usage, there was no statistical significance between the ultra-chopper and Divide & Conquer (Figure 1). But ultra-chopper needed LESS TIME and FLUID than the Divide & Conquer technique. When comparing the case time and torsional time, we found that ultra-chopper needed LESS TIME than the divide and conquer technique (Figure 2). This study presented Total

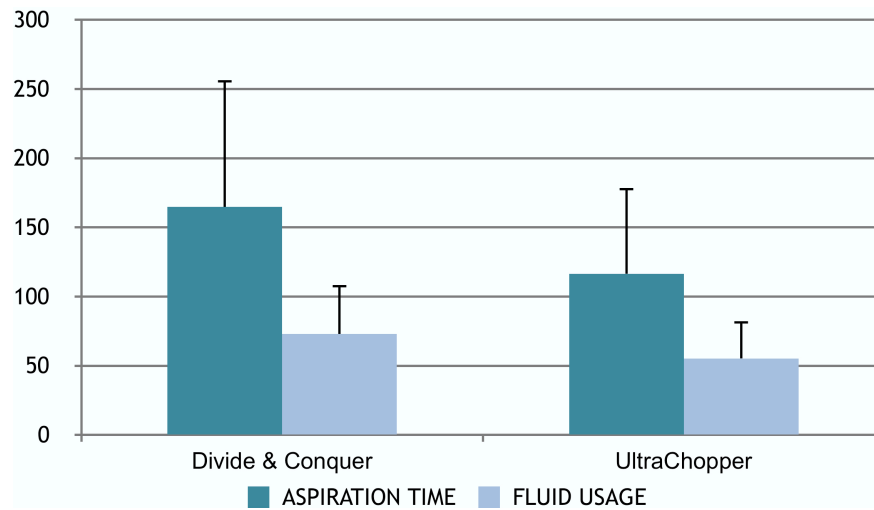


Figure 1. Comparison of aspiration time and fluid usage between ultrachopper and divide & conquer groups. Y-axis: Aspiration time in seconds and fluid usage in milliliters.

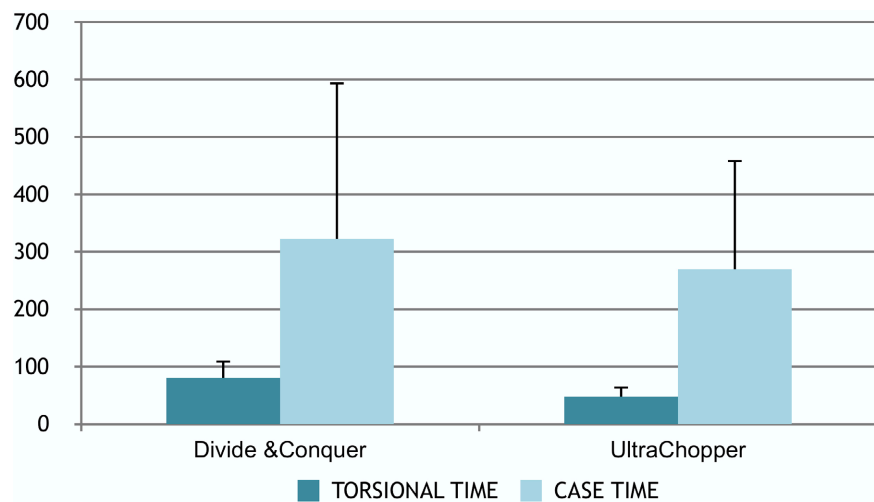


Figure 2. Comparison of case time and torsional time between ultrachopper and divide & conquer groups. Y-axis: torsional time and case time in seconds.

time and CDE, we found that ultra-chopper needed LESS TIME than the divide and conquer technique, considered extremely significant (**Figure 3**).

4. Discussion

Phacoemulsification is advancing with different microtips, sleeves and phaco torsional movement which results in a very safe procedure for patients, since it provides na earlier return to daily activities and a faster recovery of visual acuity [16] [17].

One of the principal causes of low vision is corneal edema in the early post-operative patients [17]. It is believed to be related, to a large extent to ultrasonic frequency at the phacoemulsification tip, with dissipation of ultrasonic energy, turbulent flow of fluid and lenticular particles striking the corneal endothelium [4] [5] [17].

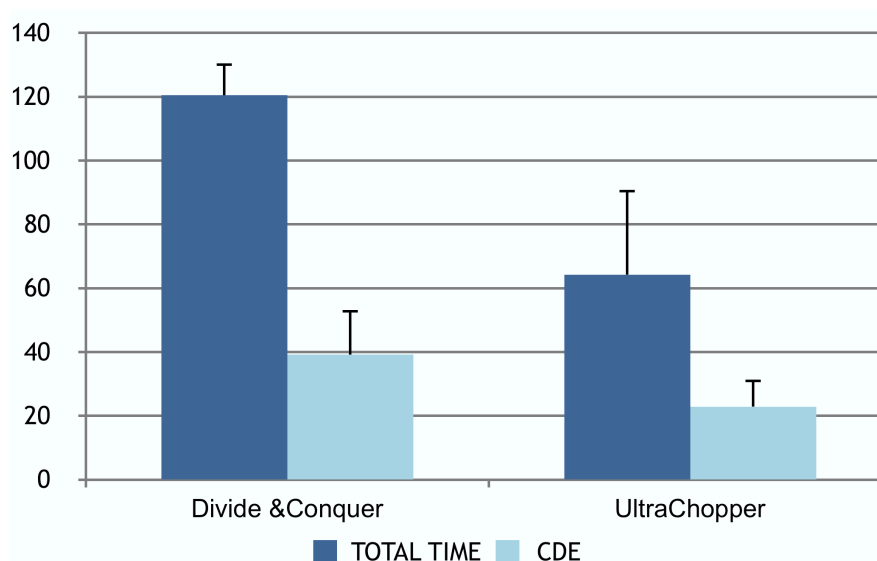


Figure 3. Comparison of total time and CDE between ultrachopper and divide & conquer groups. Y-axis: Total time in seconds and cumulative dissipated energy (CDE) in total phacoemulsification time in minutes multiplied by average phacoemulsification power % divided by 100.

Kim and associates published a similar report using the bevel-down technique comparing the mini-flared 0.9 mm 45-degree Kelman tip, the mini-flared 0.9 mm 30-degree Kelman tip, and the reverse mini-flared 0.9 mm 30-degree Kelman tip in torsional phacoemulsification cases [7].

In our study, there was no statistical significance between ultra-chopper and divide and conquer groups when comparing phacoemulsification time, CDE or torsional time.

Study of different tips reported the same results the 45-degree Kelman tip used equally the same CDE than the reverse 30-degree Kelman tip [7]. In comparison, our data suggests that both tip configurations needed statistically less time and fluid usage than the Sidewinder tip.

When comparing CDE, Phacoemulsification and Torsional times in soft and dense cataracts, there were no statistical significance between Reverse and Side-Winder tips. In the hard cataract group the Mini-Flared tip needed less Phaco-Torsional time and CDE ($p < 0.05$) than both tips. Kim and associates reported similar efficiency and CDE when compared Miniflared and Reverse tips in hard nucleus [7].

In the soft cataract group, the Reverse Tip needed less aspiration time than other tips. It is possible to assume that the surgeon's familiarity associated with bevel-down technique and tip design and use may be contributing to the favorable results in soft nucleus.

5. Summary

This study found that nuclear disassembly using the prechop technique with ultra-chopper was more effective. Associated with torsional ultrasound the ultra-

chopper improved nuclear followability and increased surgical efficiency in hard cataracts. The data show that to minimize balanced salt solution usage, torsional time and CDE in hard cataract, the Ultra-Chopper was more efficient than Divide & Conquer. Further studies are needed to evaluate the effect of ultra-chopper. New tip research should benefit from the improvement of the efficiency of phacoemulsification.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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