Comparative Study Between 'Stop and Chop' versus 'Bevel Down Quick Chop' Phacoemulsification Techniques

Thesis

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Abstract

A comparative study was made between ***group (A)*** which included 30 eyes who had phacoemulsification using the '*bevel down quick chop'* technique and ***group (B)*** which included 30 eyes who had phacoemulsification using the *'stop and chop '* technique. The two groups were compared in terms of equivalent ultrasound time, total energy consumption, the effect on the corneal endothelium efficiency in different grades of nuclear hardness, the effect on corneal wound burn and surgically induced astigmatism.In the *'quick chop'* group, the mean equivalent ultrasound time was 15.93 seconds and the mean total energy consumed was 1704.51 joules. In the 'stop and chop group, the mean equivalent ultrasound time was 27 seconds and the mean total energy consumed was 2889 joules. The mean endothelial cell loss after 3 postoperative months was 279 cells/mm^2 (11.07%) in the *'quick chop'* group compared to 407 cells/mm^2 (16.08%) in the *'stop and chop'* group. The two groups had similar effects on surgically induced astigmatism with a mean value of 0.874 D in the *'quick chop'* group and 0.75 D in the *'stop and chop'* group. We come to conclude that the 'quick chop' technique was effective in reducing the equivalent phaco time, total energy utilized and corneal endothelial cell loss in different grades of nuclear hardness as compared to 'stop and chop'.

Key Words:

Phacoemulsification- Stop and Chop- Quick Chop- bevel down

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Contents

Abbreviations

BCVA	Best corrected visual acuity
BSS	Balanced salt solution
CCC	Continuous curvilinear capsulorhexis
CDC	Crater divide and conquer
EPT	Equivalent phaco time
ICCE	Intracapsular cataract extraction
IOL	Intaocular lens
MDC	Multidirectional divide and conquer
PCIOL	Posterior chamber intraocular lens
PMMA	Polymethyl methacrylate
PPS	Pulses per second
SIA	Surgically induced astigmatism
TDC	Trench divide and conquer
UCVA	Uncorrected visual acuity

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INTRODUCTION

Since its introduction by Kelman in 1967, phacoemulsification undergoes continuous evolution in different aspects. Reduction of the ultrasound energy used inside the eye has always been the main goal for investigators and one of the most important aspects in phacoemulsification development. The reduction in ultrasound energy used inside the eye protects the corneal endothelial cells and avoids too much heat production inside the eye with all its hazards.

In the last decade, energy reduction was achieved with the modification in phacoemulsification technology and techniques. Continuous upgrading of the fluidics of phaco machines have enabled the safe use of high vacuum and flow rate levels by minimizing the risk of surge and maintaining anterior chamber stability. Power modulations and the popularity of the pulse and burst modes in modern phaco machines have also added to energy reduction. Alternatively, modifications have been made to phacoemulsification techniques by shifting from sculpting to phaco chopping and eventually to techniques that utilize higher levels of vacuum for lens disassembly and safe removal.

One of the techniques developed to reduce phaco energy utilized inside the eye was the ‘quick chop’ phacoemulsification which is essentially a vertical phaco chop technique. This technique distinguishes itself by bypassing initial sculpting and utilizing high vacuum to start vertical chopping directly from the central parts of the nucleus after its engagement by short bursts of pulsed phaco energy. Using a beveled down phaco tip allows better holdability and occlusion by the nuclear

fragments and protects the corneal endothelium from the hazardous ultrasonic energy.

Aim of the work:

The objective of this study is to evaluate the ‘bevel down quick-chop’ phacoemulsification technique and to compare it to the ‘stop and chop’ technique in terms of the equivalent phaco time and total energy consumption, the effect on the corneal endothelium, efficiency in different grades of nuclear hardness, the effect on corneal wound burn and surgically induced astigmatism, intraoperative difficulties and complications and advantages.

EVOLUTION OF PHACOEMULSIFICATION

During the 1960s and in the early 1970s, most cataract surgeries were performed by the intracapsular cataract extraction technique (I.C.C.E.) where a 180 degree incision was made, a large sector iridectomy was performed and then the lens was grasped by a capsule forceps and the entire lens was pulled from the eye, eight or more sutures were used to close the incision, and the patient remained hospitalized for about 7 days. During the early postoperative period, most of the operated upon eyes were red; the lids were swollen and irritated for up to six weeks ***(Paton and Ryan, 1973).***

The origins of phacoemulsification can be traced to the pioneering efforts of ***Kelman, 1967***, who described a single instrument technique for cataract extraction using ultrasound vibration to remove lens material through a 3-mm corneoscleral incision. To minimize posterior capsule tears and dropped nuclei, the nucleus was prolapsed into the anterior chamber and subsequently emulsified**.**

Specular microscopy studies have shown that anterior chamber phacoemulsification, prior to the introduction of viscoelastic agents, was associated with a significant reduction in endothelial cell counts ***(Kraff et al.,1980)***

In 1972, Balazs introduced sodium hyaluronate as a replacement of vitreous and aqueous humor. He introduced the term viscosurgery. Its first application in anterior segment surgery was in 1977 as a surgical aid to maintain anterior chamber in rabbits. The use of these material has become common place in anterior segment surgery . They facilitated the transition from intracapsular to extracapsular surgery and later to phacoemulsification (***Balazs, 1993).***

However, between 1973 and 1979, the results of thousands of Kelman phacoemulsification cases performed by numerous surgeons showed several factors that limited the universal application of Kelman phacoemulsification as the procedure of choice for cataract extraction ***(Gimbel, 1995).***

First, a number of reports were published showing damage to the corneal endothelium using the technique. Second was the realization that the very dense brunescent nucleus resisted ultrasonic fragmentation, making many cases difficult, dangerous, or impossible to accomplish with the instruments available. Finally, the shape of intraocular implants of the day required an incision substantially larger than 3 mm, potentially discounting any advantage of a smaller wound to remove the cataract. Nonetheless, Kelman had set the stage for further refinement of his ingenious invention ***(Gimbel, 1995).*** Eventually, the use of ultrasound to emulsify the lens nucleus did not gain wide acceptance until improvements in instruments provided the surgeon with control over phaco power and fluids. It was only toward the mid-1980s that there was an increase in interest for using phacoemulsification in cataract surgery ***(Buratto, 1998).***