Rajendra Prasad’s Terminal Chop: New Technique For Full Thickness Nuclear Segmentation in Hard Cataract

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Abstract

‘Direct chop’ has become the procedure of choice in hard cataracts but is still fraught with incomplete cracks and difficult instrument manipulation. We describe a new technique, ‘Terminal Chop’, for full thickness nuclear segmentation in hard cataract. A short, shallow, central trench is sculpted in the central nucleus, the phaco tip is engaged at the distal end of the trench and impaled into the nucleus, keeping the tip directed towards the equator parallel to the pupillary plane within the superficial layers of the nucleus. Equator of the nucleus is then slightly lifted vertically and brought out at the capsulotomy edge. A specially designed blunt tipped chopper is then simply passed around the lens equator and hooked. A small full thickness nick is created adjacent to the phaco tip using a blunt chopper. With a firm grip of the nucleus at the equator, lateral separation of the 2 instruments is initiated to create a vector force of 90 degrees, splitting the entire nucleus from equator to equator through the centre, into two complete clean halves. Direction of splitting follows the cleavage plane through the lens fibres thus causing minimal trauma.

Keywords: terminal chop, phacoemulsification, hard cataract, nucleotomy

Introduction

Hard cataracts pose a challenge to phaco surgeons due to negligible cortical and epinuclear buffering material.1 The nucleus essentially sits on the weak, fragile and thin posterior capsule such that the capsular bag is always at the risk of disruption. Nuclear fibres are tight and densely packed making the cataract very hard, leathery and unbreakable. Greatest challenge is to achieve full thickness nuclear division to initiate the nuclear emulsification. Methods currently in use, such as Divide and Conquer1 and Stop and Chop2, attempt nuclear segmentation at the thick, bulky and dense central nucleus after sculpting a large, deep and wide central trench. This requires excessive phaco power, prolonged manipulation and yet quite often fails to achieve full thickness nuclear and epinuclear segmentation in hard mature cataracts. Introduction of nuclear chopping by Nagahara3 later classified as horizontal chop4 though a popular technique still has the problems of incomplete splitting and increased manipulations.

We describe a new surgical technique, ‘Terminal chop’ that allows a successful full thickness nuclear division in a hard nucleus through the posterior plate in 100 per cent of the attempted cases, with ease and safety. This technique is very simple and effective in utilizing the advantage of unique mechanical forces to split the nucleus.

Principle

Physically hard, mature cataracts are identical to solid hard rocks- stronger in compression but weaker in tensile strength. It’s relatively easier to split or pull apart these hard rocks than to compress, chop, sculpt or fracture. Similarly to achieve full thickness nuclear segmentation it’s fundamentally better to apply lateral separation or dispersive forces instead of compressive forces, at the point of natural weakness along the cleavage plane between the lens fibres. In Terminal chop instead of compressive forces, a dispersive mechanical force is used at the thinnest and weakest equator of the nucleus. Without penetrating deep into the centre of the nucleus, phaco probe achieves firm hold of the nucleus within the equator along with blunt chopper. Lateral separation force initiated at the equator simply traverses through the entire nucleus and results into full thickness nuclear segmentation.

Technique

The Phacomachine used is WHITE STAR Signature Phacoemulsification system (Abbott Labs Inc, Illinois, USA) with FUSION fluidics and ELLIPS FX technology with a mini-flare phaco tip of 0.9 mm outside diameter and 15 degrees angled tip. Parameter settings ranging from 40% to 50% maximum power with 3 pulses, 500 mmHg maximum vacuum, 50 ml/min aspiration and flow rate are used. Simultaneous blending of longitudinal and transversal tip motion is used for sculpting and quadrant removal. After the routine incisions the anterior capsule is stained with trypan blue dye under air bubble to enhance the visibility. In accordance with soft shell strategy the dispersive viscoelastic, Viscoat, is injected into the anterior portion of the anterior chamber following which the anterior capsule is flattened with the injection of cohesive viscoelastic.

A large capsulorhexis with an intended 6.0 mm diameter is made using Utrata capsulorhexis forceps. Hydrodissection is accomplished using a disposable hydrodissection cannula and confirmed by rotating the nucleus to ensure that it is totally free inside the capsular bag. Minimal hydrodissection is attempted so as to avoid posterior capsule rupture due to sudden rise in intracapsular pressure. An specially designed angulated blunt chopper with a smooth olive tip is preferable. A short superficial central trench of 1...
Techniques

mm x 1 mm x 1 mm is sculpted in the nucleus sufficient to hold and engage the phaco tip. (Figure 1) Using the hyper pulse or burst mode with high vacuum settings, the phaco tip is then engaged at the distal end of the trench (Figure 2) and impaled into the nucleus, keeping the tip directed towards the equator parallel to the pupillary plane, within the superficial plane of the nucleus to achieve a firm grip at the periphery just within the equator of the nucleus. (Figure 3) The equator of the nucleus is lifted vertically and brought out at the capsulotomy edge. (Figure 4) The chopper is passed around the lens equator by sliding it into the space created within the capsulotomy edge to hook and engage the nucleus. (Figure 5) It is then drawn just 1 to 2 mm into the thin and softer terminal edge of the nucleus, to create a small full thickness nick adjacent to the phaco tip, simultaneously achieving a firm hold of the nucleus adjacent to the phaco tip without any horizontal excursion of the chopper. (Figure 6) A vector force is then applied to initiate the lateral separation and continued till the entire nucleus is split from the equator to equator through the centre into two complete clean halves. (Figure 7) The nucleus is then rotated 90 degrees, and the same procedure is repeated to further chop the nucleus into multiple fragments depending on the density of the lens. The lens fragments are then emulsified and aspirated. Cortical wash is performed and intraocular lens is implanted.

Discussion

A myriad of techniques have been tried for managing hard nuclei. Nuclear segmentation in these cases is often incomplete, creating problems for the surgeon leading to unnecessary manipulation, use of excessive phaco energy and subsequent unsatisfactory postoperative results. Nagahara’s phaco chop technique, primarily utilizes mechanical forces to chop and segment the nucleus in place...
The crux of Terminal Chop is:
1. Don’t go deep, stay superficial
2. Hold the nucleus at the equator, not deep at the posterior pole
3. Don’t use compressive forces. Split the nucleus with dispersive force

**Conclusion**

Terminal Chop utilizes the advantages of unique mechanical forces to effectively achieve full thickness nuclear segmentation in a hard cataract. It uses the natural cleavage plane between the fibres at the equator of the lens with minimal manipulation and minimal use of phaco energy leading to a faster recovery and maximal visual rehabilitation.

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Figure 6: Blunt chopper drawn 1.5-2 mm into the thin and softer terminal edge of the nucleus creating a small full thickness nick adjacent to the phaco tip and simultaneously achieving a firm hold of the nucleus without any horizontal excursion of the chopper.

Figure 7: Chopper and phaco tip is then separated 90° laterally to initiate the nuclear tear from the initial nick given at the equatorial edge of the nucleus.