

A Novel Technique to Seal Leaking Phacoemulsification Wound

Abstract

Purpose: To describe a novel technique for sealing of leaking phacoemulsification wound

Design: A Prospective, Cross sectional, Observational study.

Methods:

100 eyes (100 patients) of age 55 to 70 years, with senile cataract in otherwise normal eyes were included who underwent routine phacoemulsification surgery. 2.8 mm clear corneal phacoemulsification incision was made and foldable intraocular lens was implanted. At the end of surgery, lateral walls over outer two third part of clear corneal wound was hydrated with balanced salt solution. Instead of multiple attempts of wound hydration, we hydrated the wound only once and then waited for 1.5 minutes. Anterior chamber was formed by injecting fluid from side port incision. After that, counter pressure was applied to check any leakage from wound. In this study, intraoperative factors related to need for single versus multiple attempts of hydration were assessed. Also, corneal complications were noted in both the scenarios. Postoperative wound leak, endophthalmitis and visual recovery was also assessed.

Results: In 93% of our patients wound sealing was achieved with single attempt of hydration. There was no wound leak on counter pressure at end of the surgery and there was no corneal complications related to hydro sealing of wound in our patients. In remaining 7% of our patients repeat wound hydration was done and wound gets sealed after second attempt. In this 7% of cases either wound architecture was not proper (p value 0.0002) or there was wound burn (p value 0.00001) which lead to inadequate wound sealing after single attempt of hydration. Also, in this subset of patients, intraoperative corneal complications like DMD (p value 0.00001) and excessive corneal edema (p value 0.0042) was observed. Postoperative visual recovery was hastened in group with single attempt of wound hydration, though after 2 weeks both the groups achieved BCVA of 6/6. Postoperatively wound leak and endophthalmitis was not observed in any patient despite either single or multiple attempts of hydration.

Conclusion: It is a useful technique to seal leaking phacoemulsification wound in single attempt and also to avoid complications of excessive wound hydration by simple modification (waiting of 1.5 minutes before 2nd attempt).

Keywords: Hydration; Cataract; Collagen fibrils

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Introduction

Adequate sealing of wound in cataract surgery is of paramount importance, as inadequate sealing of wound allows leakage from the wound which results in postoperative hypotony and related complications. Also, it increases the risk of contamination due to ingress of bacteria which can result in devastating condition known as endophthalmitis [1]. To understand the concept of corneal wound

hydration, anatomy of corneal stroma needs to be discussed. Transparency of cornea depends on compactness and regular arrangement of collagen fibrils in the stroma. Collagen fibrils are arranged in parallel configuration in lamellae, and the lamellae are arranged at right angle to each other. Interfibrillar distance is approximately 55 nm that is maintained by intermolecular forces in the surrounding extracellular matrix [2]. In wound hydration, fluid entry expands the ground substance (mucopolysaccharide chains), which increases the spacing between collagen fibers. As the spacing increases, the orderliness of the fibres decreases, arrangement of lamellae gets disturbed and stroma swells up [3]. This results in abutting and sealing of the corneal wound. To ensure adequate wound closure in phacoemulsification, architecture of wound is of utmost importance. Usually, a clear corneal incision of 2.2-2.8mm is required which is created with keratome. At the end of cataract surgery, wound closure is achieved by hydration with balanced salt solution and after hydration wound is rechecked for any leaks. In many cases, it is observed that clear corneal incision does not get adequately sealed and to seal the incision, repeated wound hydration is done. Repeated wound hydration causes stromal edema, descemet membrane detachment, uveal pigment release, endothelium loss that may lead to excessive corneal edema [4,5]. In extreme cases it may lead to secondary glaucoma and bullous keratopathy. To avoid such complications and the need of repeated hydration, we describe a simple modification of stromal hydration to seal leaking phacoemulsification wound.

Materials and Methods

This is prospective, cross sectional, observational study done in an Institutional practice (D.D. Eye Institute, Kota, Rajasthan). We studied this technique in 100 eyes of 100 patients, age group 55-70 years. Informed consent was obtained from all the patients. All patients with senile cataract in otherwise normal eye were included in study. Patients with active ocular infection, recent inflammation, IOP>30mmHg, previous corneal refractive procedures, conditions affecting corneal transparency, corneal scars, traumatic cataract and phacoemulsification cases converted to ECCE were excluded. All the recruited patients were seen pre-operatively on slit lamp by operating surgeon. All patients underwent routine phacoemulsification surgery by same surgeon. 2.8 mm clear corneal phacoemulsification incision was made, phacoemulsification was done and single piece foldable intraocular lens was implanted. At the end of surgery, lateral walls over outer two third part of clear corneal wound was hydrated with balanced salt solution. Instead of multiple attempts of wound hydration, we hydrated the wound only once and then waited for 1.5 minutes. After 1.5minutes, fluid was injected from side port incision to check wound sealing. After that, counter pressure was applied to check any leakage from wound. Intraoperative factors were assessed in patients who require multiple attempts of wound hydration. Also, complications related to multiple attempts of hydration were evaluated. Postoperative wound leak, endophthalmitis, visual recovery were also assessed. Statistical analysis was done using SPSS calculator and p value of <0.01 was considered significant.

RESULTS

The age range for inclusion in this study was between 55 to 70 years. In the study group males and females were age-matched ($p=0.28$, t test). It was observed that out of 100 patients, 93 patients (93% of patients) achieved wound sealing with single attempt of wound hydration, only 7 patients (7% of patients) required multiple attempts of hydration for sealing the wound. For further analysis purpose, we have labelled patients requiring single hydration attempt for wound sealing as Group A ($n=93$) and patients requiring multiple wound hydration attempts as Group B ($n=7$) and various factors have been studied in these groups as discussed below. We observed that among these 7 patients, wound burn was seen in 4 patients and distorted wound architecture was seen in 2 patients and 1 patient had both wound burn and distorted wound architecture. These were not seen in any of patient requiring single attempt of wound hydration. It was observed that there was significant difference related to wound burn (p value 0.00001, Fisher Exact test) and poor wound architecture (p value 0.0002, Fisher Exact test) in group B. Also, it was interesting to note that wound burn was observed in patients with nuclear sclerosis $\geq$ grade 4, related to amount of energy required for emulsification of such cataract. We also observed few complications related to multiple attempt of hydration among these 7 patients. Descemet membrane detachment (DMD) was seen in 5 patients and excessive corneal edema was seen in 2 patients. None of patients with single attempt of hydration had these complications. On analysis, it was noted that these were more significant in group B. There was significant difference related with DMD (p value 0.00001, Fisher Exact test) and with excessive corneal edema (p value 0.0042, Fisher Exact test). None of the cases had postoperative wound leak or endophthalmitis on follow up. Visual recovery was hastened in group A, though both the groups achieved BCVA of 6/6 after 2 weeks on follow up.

Discussion

Various techniques are described in literature for phacoemulsification wound hydration. The conventional approach is to hydrate the lateral walls of the clear corneal incision, which results in visible stromal whitening [6]. As already described, repeated attempts of hydration for wound sealing can lead to various complications such as descemet membrane detachment (DMD), wound architecture distortion, excessive stromal edema^{4,5} that can reach upto centre and may lead to delay in visual recovery. Alternative is the "Wong Incision", which involves creation of supra incisional pocket and hydration of the pocket for wound closure [7]. The proposed benefits of this approach are thought to arise from pressure sealing of wound. However, in practice, the depth of the supra-incisional pocket is not easy to determine and may disturb wound architecture [8]. Wound hydration by inserting 30G needle into corneal stroma has been described⁸. In this technique, 30 G needle was attached to 2ml syringe filled with balanced salt solution and wound was hydrated by burying needle into corneal stroma. This technique was reported to have less wound architecture distortion and comparatively less chance of descemet membrane

detachment⁸. But it requires experience and learning curve to bury the needle in correct depth of stroma which prolongs surgical time. Also, risk for corneal epithelial damage exists [9]. The use of glue to seal corneal incisions is currently an active area in ophthalmologic research. A variety of sealants have been described. However, there is a concern regarding the risk of viral transmission with Fibrin derivative glue due to their composition and preparation [10]. Cyanoacrylate derivatives have been shown to be effective in wound sealing [11]. However, it is suggested that these adhesive substances may cause adverse effects including increased inflammation, neovascularization, and foreign body sensation [12]. Recently, FDA has approved Resure, an adhesive ocular sealant for water tight closure of phacoemulsification wound [13].

The technique we describe is simple and effective for hydro sealing of leaking corneal wound. It is beneficial in terms of avoidance for the need of repeat wound hydration attempts to seal the wound. There is no learning curve of this technique. With some precautions, wound hydration can be attempted without wound distortion and keeping little patience, surgeon can wait for 1.5 minutes after single attempt of hydro sealing of wound.

Waiting time of 1.5 minutes results in increased distance between collagen fibrils in stroma due to uncoiling of the interlamellar muco-polysaccharide chains which results in swelling of corneal stroma by increasing its thickness upto 2.5 times. This results in abutting and sealing of the wound without need of multiple hydration attempts. This also prevents complications which are seen after repeated wound hydration. Another benefit of this technique is that we hydrated outer two third part of corneal wound which prevents complications related to hydro sealing of wound such as descemet membrane detachment, excessive stromal edema, and excess pigment release

Conclusion

This technique of modified phacoemulsification wound hydration has not been described in the literature earlier. It is a useful technique to seal leaking phacoemulsification wound and also

to avoid complications of excessive wound hydration by simple modification. Due to avoidance of complications related to hydro sealing of wound, the visual recovery is hastened postoperatively.

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