Diamond burr superficial keratectomy for recurrent corneal erosions

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Aims: To evaluate the efficacy and safety of diamond burr superficial keratectomy in the treatment of recurrent corneal erosions.

Methods: A retrospective review of 54 eyes (47 patients) with recurrent corneal erosions treated with diamond burr superficial keratectomy. Preoperative and postoperative visual acuities and refractions, slit lamp examination findings, and the incidence of recurrent erosion after keratectomy were studied. Specular microscopy was also performed in six patients before and after surgery.

Results: 30 eyes had underlying map dot fingerprint anterior basement membrane corneal dystrophy, while 24 eyes did not. Postoperative follow up time ranged from 3 to 53 months (mean 12.3 months). Corneal erosion recurred in three eyes (6%) after diamond burr superficial keratectomy. This procedure improved the best corrected visual acuity from 20/26 to 20/22 by logMAR statistical evaluation (p=0.002) and caused very little change in the refractive spherical equivalent. No endothelial cell loss or changes in morphology were noted on specular microscopy.

Conclusion: Diamond burr superficial keratectomy appears to be an effective and safe method of treating recurrent erosions and is a good alternative therapy to needle stromal micropuncture, Nd:YAG induced epithelial adhesion, and excimer laser surface ablation.

Recurrence of corneal erosions can not only be frightening and frustrating for the patient, but also a disabling condition. Mechanically, they may have a protracted clinical course. Abnormalities in epithelial adhesion, which form the basis of this disorder, are frequently associated with previous traumatic abrasions or with corneal dystrophies. There is loss or damage to the ultrastructural adhesional complexes normally responsible for the attachment of the epithelial layer to its underlying substrate. Although many cases of recurrent erosion respond satisfactorily to lubrication, patching, topical hypertonic agents, and bandage contact lenses, the more stubborn cases may require surgical intervention.

Surgical treatments include simple epithelial removal, needle or Nd:YAG laser induced anterior stromal micropuncture, excimer laser surface ablation, and superficial keratectomy with either lamellar dissection or with diamond burr polishing. Simple epithelial peeling or scraping may not be effective in cleaning the substrate totally free of abnormal basement membrane, and consequently can be associated with higher rates of recurrence. Needle anterior stromal micropuncture therapy, although very effective with low recurrence rates, produces multiple focal, permanent scars in the cornea and has a small risk of corneal perforation. Although isolated, small focal corneal scars in the visual axis have never been documented to cause decreased vision or glare symptoms, we believe that it is, nevertheless, best to avoid inducing any opacities in the line of sight. Nd:YAG laser induced adhesion of the epithelium similarly produces multiple focal breaks in basement membrane and Bowman’s layer, and is associated with low rates of recurrence. Because this technique produces minimal scarring, it is safer than needle micropuncture for treatment of the visual axis. Excimer laser phototherapeutic keratectomy is also very effective in treating recurrent erosions, but is associated with a postoperative refractive shift towards hyperopia. However, superficial treatment of less than 10 μm would not be expected to cause a significant hyperopic shift. Both Nd:YAG and excimer laser treatments require large, expensive, highly sophisticated equipment. In a poster presentation, Forstot and coworkers in 1994 reported good success with mechanical superficial keratectomy for recurrent erosions, especially when combined with diamond burr polishing of Bowman’s layer.

METHODS AND PATIENTS

The clinical records of 47 consecutive patients (54 eyes) who underwent DBSK at the WK Kellogg Eye Center (by surgeons HKS, RFT, and AS) were reviewed. Additional history and follow up data were collected from the referring ophthalmologists when indicated. The M:F sex distribution was essentially equal with 28 males and 26 females, and the mean patient age was 50 at the time of surgery (range 21–67 years). The mean duration of recurrent corneal erosions before diamond burr keratectomy was 48 (range 2–67) months and the mean post-operative follow up time was 12.3 months (range 3–53). All eyes had been treated with at least one other mode of therapy before undergoing DBSK. These methods included the use of lubricants, artificial tears, hyperosmotic agents, patching, bandage soft contact lenses, needle stromal micropuncture, simple epithelial peeling, and excimer laser phototherapeutic keratectomy. Thirty of 54 eyes had map dot fingerprint dystrophy, while the remaining 24 eyes had no evidence of underlying anterior dystrophies.

The DBSK surgeries were performed in the minor outpatient procedure room under an operating microscope and under topical anesthesia consisting of oxybuprocaine (proparacaine) and/or amethocaine (tetracaine). After sterile preparation and draping, a wire eyelid speculum was inserted. Loose sheets of epithelium were debried from the cornea, using a combination of peeling with forceps and gentle wiping with an iris spatula or cellulose sponge. In all cases in which the erosions were close to or within the visual axis (44 eyes), the
into spherical equivalents in order to evaluate refractive visual acuities was performed with the logMAR (log of the minimum angle of resolution) test. The mean preoperative and postoperative dioptric spherical equivalents by manifest refraction were –1.38 (SD 2.95) and –1.41 (2.58), respectively. The change in spherical equivalent from before to after DBSK was −0.37 (0.15). Forty-nine eyes (91%) had <0.50 dioptre change in the spherical equivalent after DBSK, while five eyes (9%) had >0.50, but <1.50 dioptre change.

Three eyes (6%) had a recurrent corneal erosion within 2 months after DBSK; however, following re-treatment with DBSK, none of these eyes had further recurrences in at least 2 years. Two of the three eyes with recurrence had underlying map dot fingerprint dystrophy. Although no eyes had anterior stromal scarring resulting from the procedure, 11 eyes did show faint anterior stromal haze lasting about a month before fading. Specular microscopy of the endothelium showed neither evidence of morphological change nor decreases in cell density (p<0.05).

### RESULTS

Before DBSK, all 54 eyes had failed on medical treatment for recurrent erosion, which consisted of artificial tears, lubricating ointments, patching, hypertonic agents, and bandage contact lenses. Twenty-nine eyes had undergone sometimes multiple surgical interventions for their recurrent erosions. Twenty-five of these eyes had undergone needle stromal micropuncture therapy or Nd:YAG laser surface ablation. Three had undergone simple epithelial debridement, and one had undergone excimer laser surface ablation. In each case, corneal erosions recurred within 2 months after these antecedent surgeries.

DBSK improved the best corrected visual acuity from 20/26 (logMAR 0.107) to 20/22 (logMAR 0.043) by logMAR statistical evaluation (p=0.002). The mean preoperative and postoperative dioptric spherical equivalents by manifest refraction were –1.38 (SD 2.95) and –1.41 (2.58), respectively. The change in spherical equivalent from before to after DBSK was −0.37 (0.15). Forty-nine eyes (91%) had <0.50 dioptre change in the spherical equivalent after DBSK, while five eyes (9%) had >0.50, but <1.50 dioptre change.

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#### DISCUSSION

It has been over 125 years since recurrent corneal erosion syndrome was first described by Hansen in the Danish literature. In 1906, Franke treated recurrent corneal erosion by debriding the epithelium and applying chlorinated water. Over a 3 year period, only two of his patients required re-treatment. Thygeson reported a 60% cure rate in 1959 with chemical cautery with iodine. Buxton and Fox reported in 1984 an 85% success rate with total epithelial debridement, followed by use of bandage contact lens therapy. Wood described excellent results using superficial corneal puncture therapy with diathermy. McLean and coworkers observed 10% recurrence in 1984 and 1% recurrence in 1986. Furthermore, McLean and coworkers have described the use of Nd:YAG laser superficial corneal spots instead of needles showing good results with less scarring. In 1987, Constand reported a 3% recurrence rate in patients treated with total epithelial debridement when they polished the limbus with a diamond burr; however, they did not polish the central cornea.

Our study strongly suggests that DBSK is a safe and effective treatment of recurrent corneal erosions. It appears to be a good alternative surgical therapy to simple epithelial debridement, needle stromal puncture, Nd:YAG laser induced epithelial debridement, and excimer laser anterior corneal ablation. Table 1 enumerates the advantages and disadvantages of this technique in comparison with other current surgical modes of therapy.
excimer ablation, are unknown. It is generally accepted that these procedures may involve reactive fibrosis or production of extracellular matrix proteins responsible for proper adhesion of the epithelium to its substrate. Brown and Bron noted that epithelial debridement alone was no more effective than medical therapy alone, and that scarring of Bowman's layer might be necessary for prevention of recurrent erosions.

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REFERENCES
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