

Temporary Relief of Pain and Improved Vision in Patient with Bullous Keratopathy by Increasing Micro-Environment with a Specially Designed Soft Contact Lens Resulting in Decrease of Corneal Oedema and Pain Relief

Claes Feinbaum^{1*} and Ante Barisic²

¹Research Professor of Ophthalmology and Optometry, Ben Gurion University of the Negev, Israel

²Department of Refractive Surgery, University of Zagreb, Croatia

***Corresponding Author:** Claes Feinbaum, Research Professor of Ophthalmology and Optometry, Ben Gurion University of the Negev, Israel.

Received: March 17, 2016; **Published:** May 17, 2016

Abstract

Bullous Keratopathy is the presence of corneal epithelial bullae, resulting from corneal endothelial disease. Bullous Keratopathy is caused by oedema of the cornea, resulting from failure of the corneal endothelium to maintain the normally dehydrated state of the cornea. Most frequently, it is due to Fuchs corneal endothelial dystrophy or corneal endothelial trauma. Fuchs dystrophy is a genetic disorder that causes bilateral, progressive corneal endothelial cell loss, sometimes leading to symptomatic bullous keratopathy by age 50 to 60. Fuchs dystrophy may be autosomal dominant with incomplete penetrance. Another frequent cause of Bullous Keratopathy is corneal endothelial trauma, which can occur during intraocular surgery (e.g., cataract removal) or after placement of a poorly designed or mal-positioned intraocular lens implant. Bullous Keratopathy after cataract removal is called pseudophakic (if an intraocular lens implant is present) or aphakic (if no intraocular lens implant is present) bullous keratopathy.

Sub-epithelial fluid-filled bullae form on the corneal surface as the corneal stroma (the deeper layers of the cornea) swells, leading to eye discomfort, decreased visual acuity, loss of contrast, glare and photophobia. Sometimes bullae rupture, causing pain and foreign body sensation. Bacteria can invade a ruptured bulla, leading to a corneal ulcer.

The bullae and swelling of the corneal stroma can be seen on slit-lamp examination.

Treatment requires an ophthalmologist and includes topical dehydrating agents (e.g., hypertonic saline), intraocular pressure-lowering agents, occasional short-term use of therapeutic soft contact lenses for some mild to moderate cases and treatment of any secondary microbial infection. Corneal transplantation is usually curative.

A new modality of reducing signs and symptoms and improve living quality in Bullous Keratopathy patients has been developed by Israel based company Eye-Yon Medical, namely the Hyper CL™. The unique structure of the Hyper-CL™ facilitates extraction of fluid from the corneal stroma and increased evaporation over the lens surface. The dual base curve combined with the groove and the holes within the lens create a micro-environment above the cornea center that will increase contact time of any solution applied to the lens surface.

After 10 days of wear of the lens, the corneal oedema caused by the Bullous Keratopathy was reduced by 110µ and there was significantly less pain and slight improvement of vision.

Keywords: Bullous keratopathy; Corneal oedema; Soft contact lens; Pain relief

Introduction

Corneal transparency is a large part, dependent on the ability of the cornea to remain in a dehydrated state. It is affected by several in-

terdependent factors. The epithelium and the endothelium are both semi permeable membranes that create a barrier to the flow of water and other electrolytes into the cornea. Evaporation from the corneal tear film results in slightly hypertonic tears that tend to draw fluid out of the cornea. Intraocular pressure tends to drive fluid into the cornea. Osmotic forces and the electrolyte balance within the corneal stroma also tend to draw water into the cornea. However, the most important influence on corneal deturgescence is the presence of an active metabolic pump in the endothelium.

The endothelium is a single layer of cells present on the back of the cornea. The site of the metabolic pump is within the lateral cell membrane, it is temperature dependent, it is associated with the enzyme Na^+/K^+ ATPase and it is inhibited by g-strophanthin. Endothelial cells produce a basement membrane (Descemet's membrane) and they are of neuro-ectodermal origin. Cell density at birth can be as high as 7500 cells/mm², decreasing to an average of about 2500-2700 cells/mm² in older adults.

Endothelial cells are not capable of significant mitotic activity. The normal rate of endothelial loss after age 20 years is approximately 0.5% per year. Surgical trauma, inflammation, and corneal dystrophies can accelerate this normal aging loss. The final common pathway in the development of Bullous Keratopathy is damage to the corneal endothelium, when the cell density reaches a critically low level of about 300-500 cells/mm², corneal oedema develops [1].

With the Hyper CL™ a new treatment option for reducing corneal oedema associated with Bullous Keratopathy and pain is now available and this treatment is dealt with in this case report.

Clinical Findings

A female Caucasian patient, aged 75, old age pensioner, had presented at the clinic a number of times. For her age she was in fairly good health, having had cataract surgery in both eyes some years back (Cataract surgery not performed by this clinic and in another town, records of surgery not available). UCVA in the right eye was 0.1 and BCVA 0.4. And she was happy with this. However, her main complaints regarding the left eye were very poor vision, haloes around lights, pain, foreign body sensation and very light sensitive. UCVA was 0.01 and BCVA 0.01. The IOP by Goldmann Applanation Tonometry was 17 mmHg. The central corneal thickness measured by OCT was 850µ. Slit lamp bio-microscopy examination revealed folds in the Descemet's membrane and obvious overall thickening of the central and peripheral cornea. Guttate excrescences were observed as golden-brown confluent endothelial lesions and giving the posterior corneal surfaces a characteristic beaten metal appearance. The retina could not be observed. The diagnosis given was Bullous Keratopathy based on the symptoms and the bio-microscopy findings [2].

Time Line

Date	11/9/2015	12/9/2015	13/9/2015	1/10/2015	15/10/2015	17/10/2015
Action	1 st visit	Lens Insertion	1 st Follow-up	Lens cleaning	End of Trial	Follow-up

Diagnostic focus and assessment

External examination of eyes consists of inspection of the eyelids, surrounding tissues and palpebral fissure. Palpation of the orbital rims was performed. The conjunctiva and sclera were inspected by having the individual look up and shining a light while retracting the upper or lower eyelid. The position of the eyelids was checked for abnormalities such as ptosis which is an asymmetry between eyelid positions.

Close inspection of the anterior eye structures and ocular adnexa was performed with a slit lamp, which is a table mounted microscope with a special adjustable illumination source attached. A small beam of light that can be varied in width, height, incident angle, orientation and colour, is passed over the eye. Often, this light beam is narrowed into a vertical "slit", during slit-lamp examination [3].

The binocular slit-lamp examination provides stereoscopic magnified view of the eye structures in striking detail, enabling exact anatomical diagnoses to be made for a variety of eye conditions.

Ophthalmoscopy was not performed since the cornea was opaque and gonioscopy examination was not performed due to the state of the cornea.

Intraocular pressure (IOP) by GAT. The eye can be thought of as an enclosed compartment through which there is a constant circulation of fluid that maintains its shape and internal pressure. Tonometry is a method of measuring this pressure using various instruments. The normal range is 10-21 mmHg. In this case the Goldmann Applanation tonometer was used (GAT) [4].

Examination of retina (fundus examination) is an important part of the general eye examination. Dilating the pupil using special eye drops greatly enhances the view and permits an extensive examination of peripheral retina. Retinal examination in this case was not possible due to opaque cornea.

A red reflex can be seen when looking at a patient’s pupil through a direct ophthalmoscope. This part of the examination is done from a distance of about 50 cm and is usually symmetrical between the two eyes. Opacity may indicate a cataract and this was the case here in the right eye. The patient was previously operated for cataract. In the left eye it was not possible to examine the IOL and its state.

Vision was decreased in proportion to the development of central corneal oedema. Slit lamp examination revealed folds in the Descemet’s membrane and obvious overall thickening of the central and peripheral cornea. Vesicles and bullae were seen on the corneal surface.

In patients with predisposing corneal problems (e.g., Fuchs dystrophy), cornea guttata were seen. On slit lamp examination, guttata excrescences appeared as golden-brown confluent endothelial lesions and gave the posterior corneal surface a characteristic beaten metal appearance. The diagnosis was clear with Bullous Keratopathy [5].

Therapeutic focus and assessment

- Selection of suitable patient
- Lens insertion
- Administering 5% NaCl on top of lens once lens has settled (time frame about 10 minutes)
- Instructing patient how to administer drop (1-2 drops per time) morning and evening
- Instructing patient to remove and insert lens
- Lens removal once a week by patient for rinsing
- Lens removal at clinic after 2 weeks for cleaning and disinfection and re-insertment
- After third week rinsing of lens by patient
- After 4 weeks removal of lens at clinic

Follow-up and outcomes

13/9/2015	20/9/2015	23/9/2015	8/10/2015	15/10/2015	17/10/2015
1 st Follow-Up	Lens cleaning By patient	2 nd follow-up	Lens cleaning By patient	End of Hyper CL™ Treatment	Corneal Evaluation

At the first follow-up OCT was performed and the result was a substantial decrease of the corneal oedema from 850µ to 740µ. The scale of pain used was from 1 to 10 where 10 were much pain and 1 minimal or hardly noticeable pain. Before lens insertion patient noted down an 8 on the pain scale, and at 1st follow-up pain was decreased to 3. The UCVA improved from 0.01 to 0.03. BCVA improved from 0.01 to 0.03 as well. At the end of the trial after 1 month usage the cornea had swelled to 800µ and pain level remained at 3 (Normally the lens should have been exchanged after 14 days but due to unforeseen circumstances no new lenses were available after 14 days. This indicates that the efficacy of the lens had decreased and now served as a bandage lens only).

All lens materials gradually deteriorate in their performance, both optically, in comfort (upon insertion, during the day and at the end of the day) and in oxygen transmissibility. This is primarily due to the accumulation of deposits on the surface and in the material of the

lens, starting from the first time of wear. With some materials it happens faster than others, which have excellent features over a short wearing time. The recommended replacement frequency is the result of clinical studies with many patients, reflecting the various wearing habits, tear film quantity and quality, care regimes as well as material characteristics in terms of ability to withstand handling and speed of surface degradation. The recommended replacement frequency is, therefore, a time period for which proper performance is assured for many users. However, for some users the eye care professional has to select shorter times to deliver equal comfort and vision during their use.

The patient was so happy with the lens and the pain relief, so it was agreed that she could use it for 1 month. Normally the lens should be exchanged after 14 days. 2 days after lens removal, the cornea had swelled again and was back to baseline 840μ and the pain was back.

Conclusion

These new treatment modalities with the Hyper CL™ certainly have a place in the treatment of Bullous Keratopathy. Further studies with larger groups are necessary to really establish safety and efficacy of the Hyper CL™ for this kind of treatment where the cornea is highly damaged due to oedema. An extra bonus of the lens is of course the pain relief for the patient.

Bibliography

1. Gomes JAP, *et al.* "Anterior Stromal Puncture in the Treatment of Bullous Keratopathy: Six-Month Follow-Up". *Cornea Journal* 20.6 (2001): 570-572.
2. Cormier G., *et al.* "Anterior Stromal Punctures for Bullous Keratopathy". *Archives of Ophthalmology Journal* 114.6 (1996): 654-658.
3. Maini R., *et al.* "A Comparison of Different Depth Ablations in the Treatment of Painful Bullous Keratopathy with Phototherapeutic Keratectomy". *British Journal of Ophthalmology* 85.8 (2001): 912-915.
4. Alio JL., *et al.* "Automated Superficial Lamellar Keratectomy Augmented by Excimer Laser Masked PTK in the Management of Severe Superficial Corneal Opacities". *British Journal of Ophthalmology* 88.10 (2004): 1289-1294.
5. Uchino Y., *et al.* "Long-Standing Bullous Keratopathy is Associated with Peripheral Conjunctivalization and Limbal Deficiency". *Journal of Ophthalmology* 113.7 (2006):1098-1101.

Volume 3 Issue 4 May 2016

© All rights reserved by Claes Feinbaum and Ante Barisic.