The author has no financial interests or relationships to disclose

Novel Drug Repository Contact Lens Study: Prolongation of Corneal Anti-Microbial Contact in Bacterial Keratitis

Poster Number: **74162**

Prof. Lional Raj Daniel Ponniah M.D.,
Dr Agarwal's Eye Hospitals, Tirunelveli, India
drlionalraj@gmail.com

Background

- Up to 5% of all blindness are due to infections.
- Microbial keratitis (MK) as a cause of unilateral blindness range from 1.5 to 2 million cases per year
- Approximately 1 million clinical visits to health practitioners and 58,000 registered emergency departments per annum in the US
- Prevalence of MK are as high as 113 per 100,000 in South India
- Topical antibiotic eye drops are the preferred treatment option, presently
- The pre-corneal factors and anatomical barriers negatively affect the bioavailability of topical formulations at the lesion.

PURPOSE: To evaluate the efficacy of a novel therapeutic contact lens that increases the overall contact time of corneal antimicrobial drug (serving as a drug reservoir) in subjects with bacterial keratitis.

SETTING: A Prospective, interventional, clinical trial, at the Dept. Of Cornea, Dr Agarwal's Tirunelveli, S.India

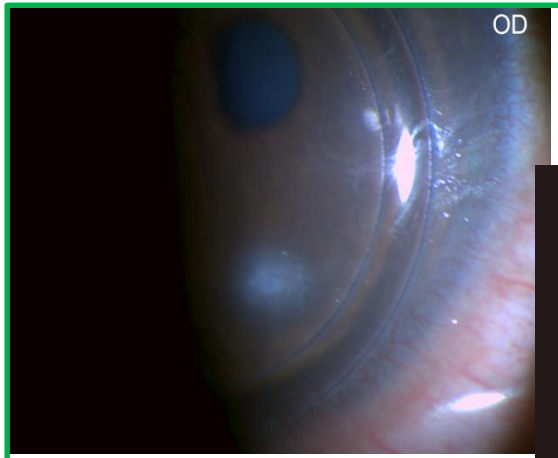
METHODS: 15 Bacterial keratitis were enrolled. Unique drug-reservoir contact lenses with characteristic dual base curves resulting in a central reservoir for retention of drugs along with fenestrations to enable capture of applied topical antimicrobials, were implanted.

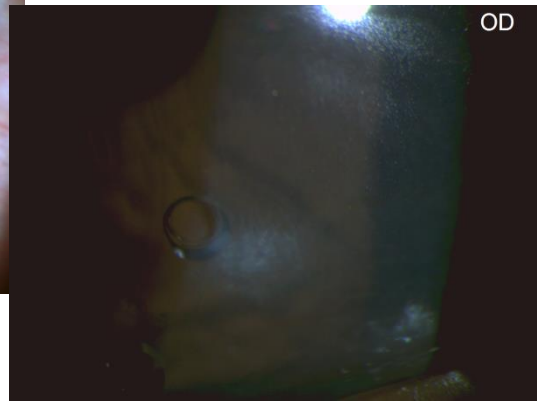
The ulcer, infiltration (Bacterial Keratitis Severity Scores) & depth of the lesions were studied and stratified into Category-1 (less than 3mm) and Category-2 (over 3mm).

Followed-up on Days 1,3,5 & 14. Pain evaluated with a ten-point scale.

Monotherapy of antimicrobials with 2-Hrly dosing during waking hours (first 3 days), followed by 4-Hrly till recovery was employed.

In addition a study on the availability of drug in the central reservoir was analysed over time curve.

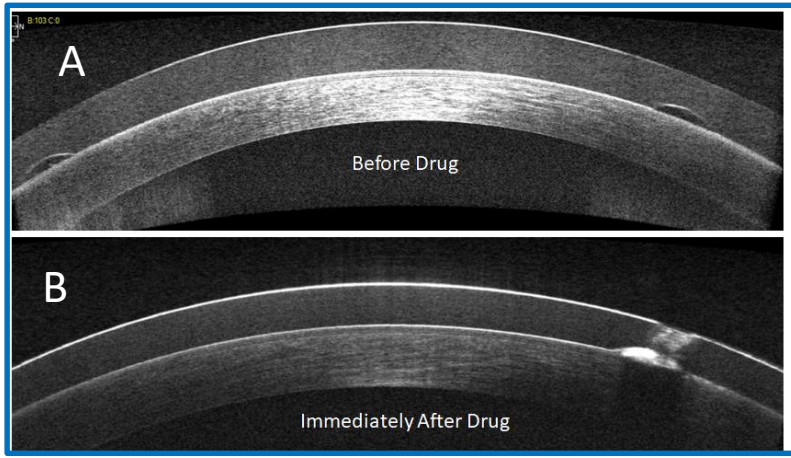




•The lens material consists of 41% Acofilcon A and 59% water in a buffered solution.

•The Lens incorporates FENESTRATIONS and a central reservoir due to DUAL BASE-CURVES .

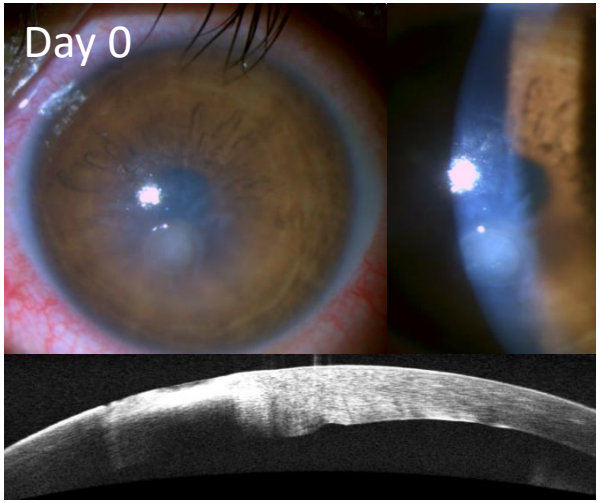
•The lens's unique design enables the capture and maintains a drop of solution applied to the contact lens surface

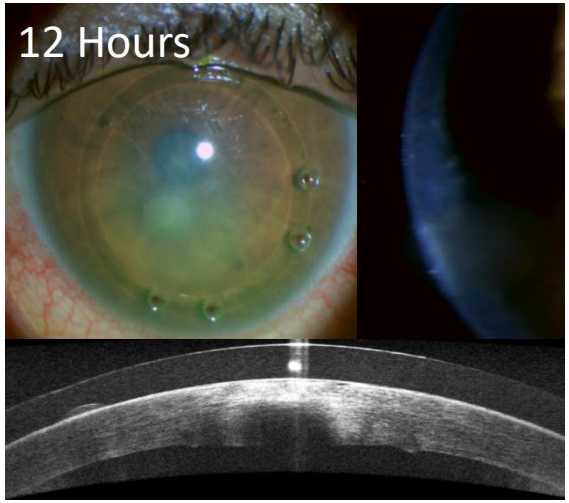


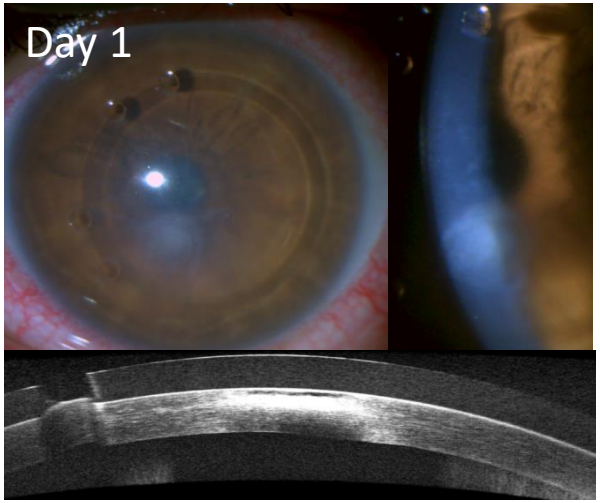
Normal Cornea + Drug Repository CL

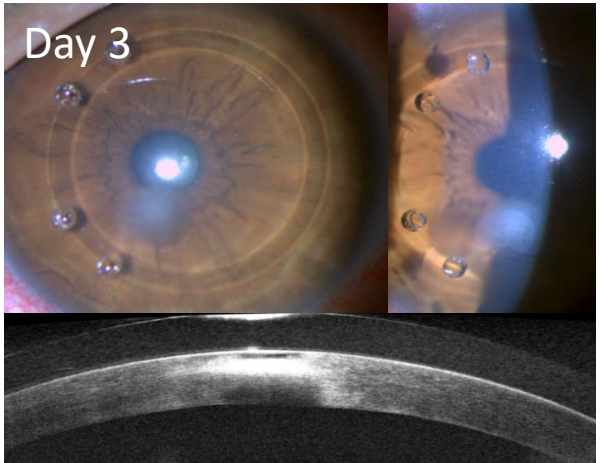
Contact Lens Thickness – 140 microns
Tear film (Admixed with drug) -200 microns

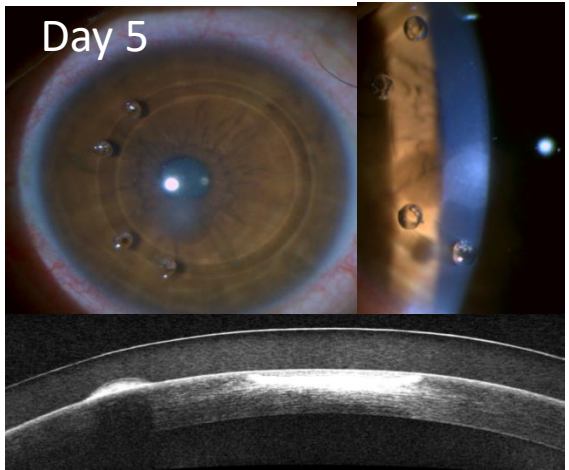
Category -1 (Less than 3mm) – Case Ex. -1

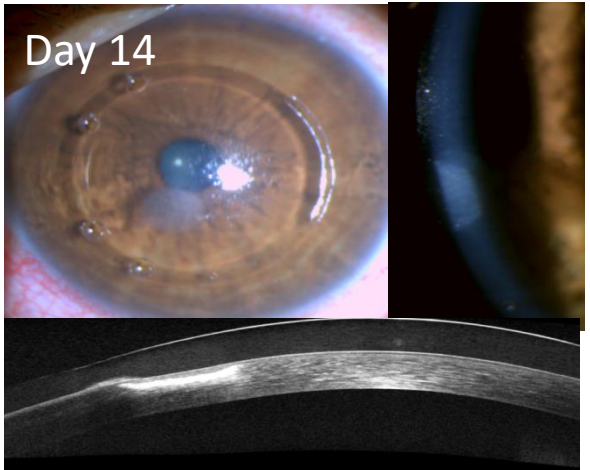




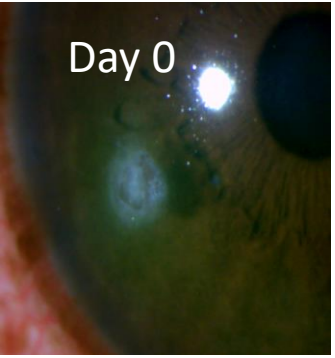


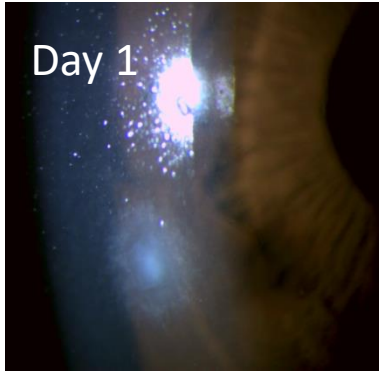


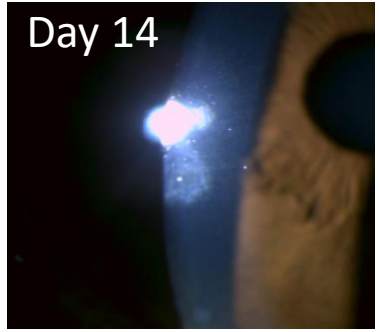


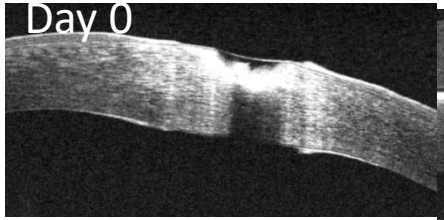


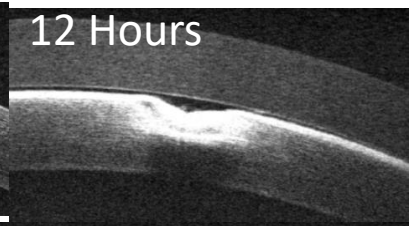
Category -1 (Less than 3mm) – Case Ex. -2

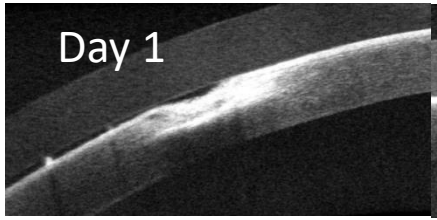


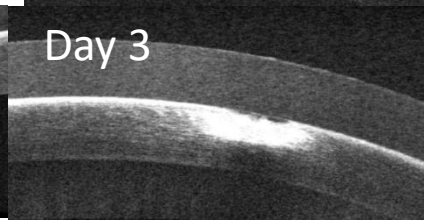


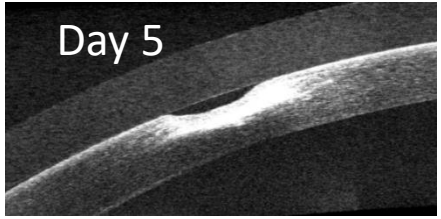




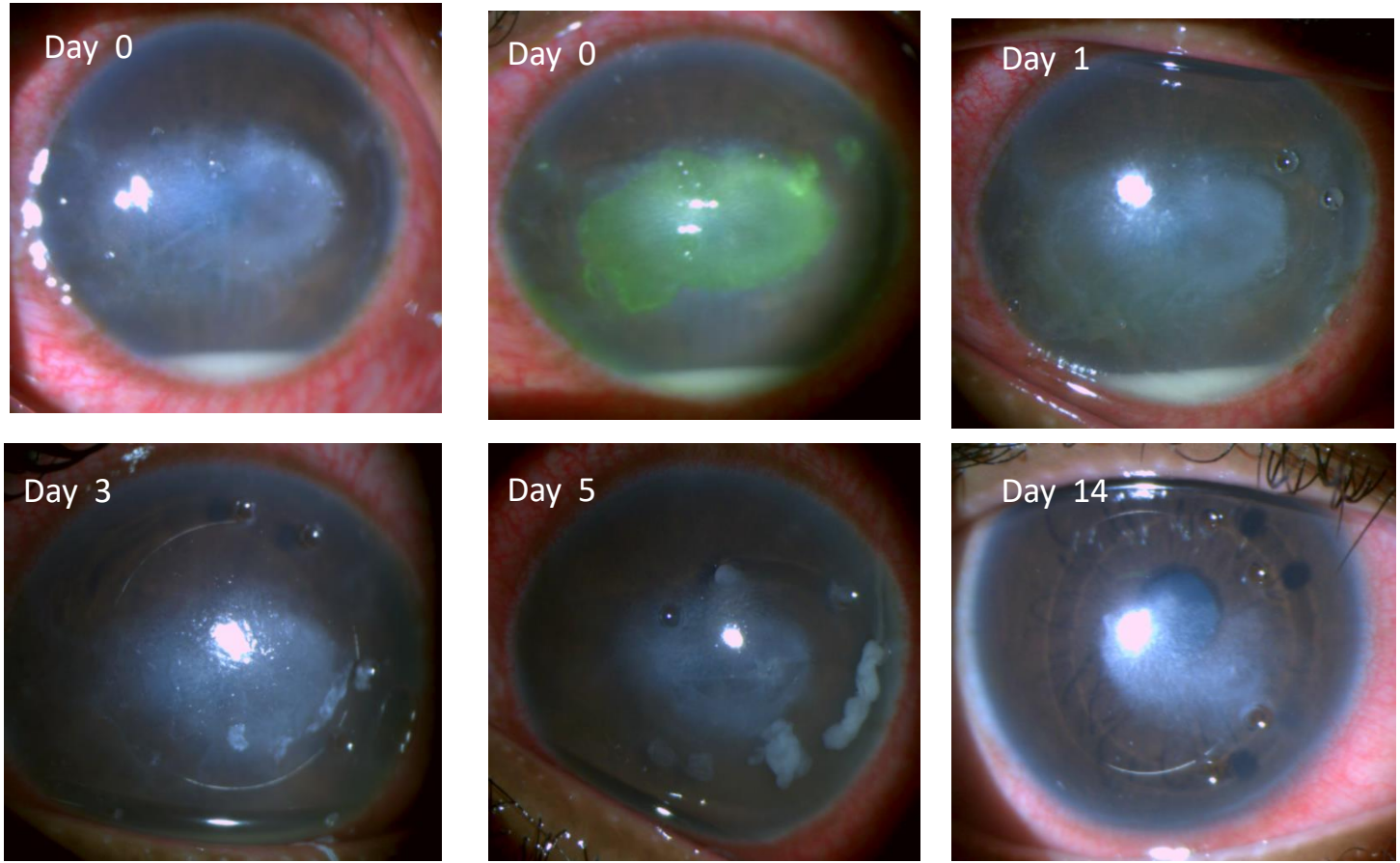






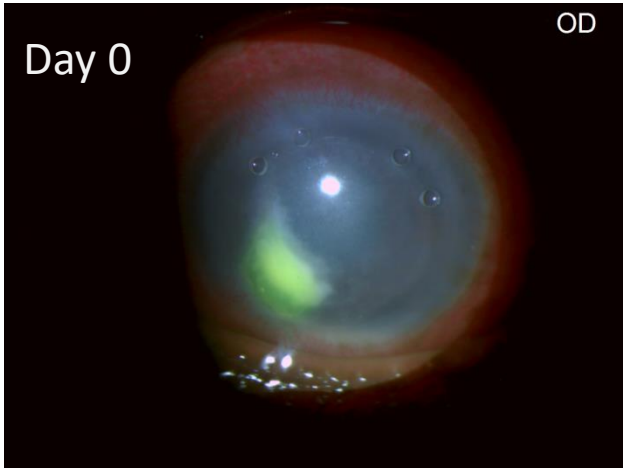


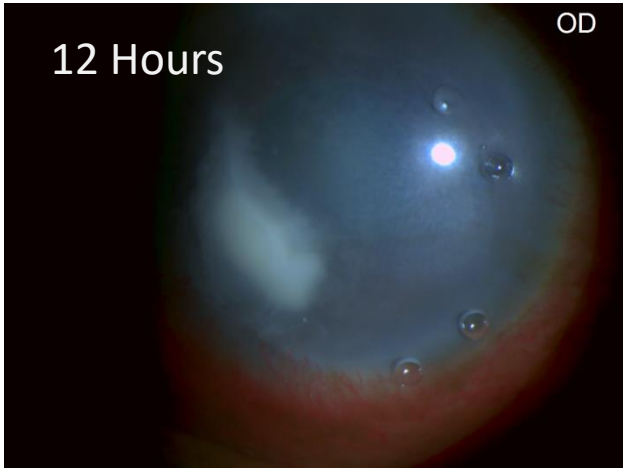
Category -2 (Over 3mm) – Case Ex. -1

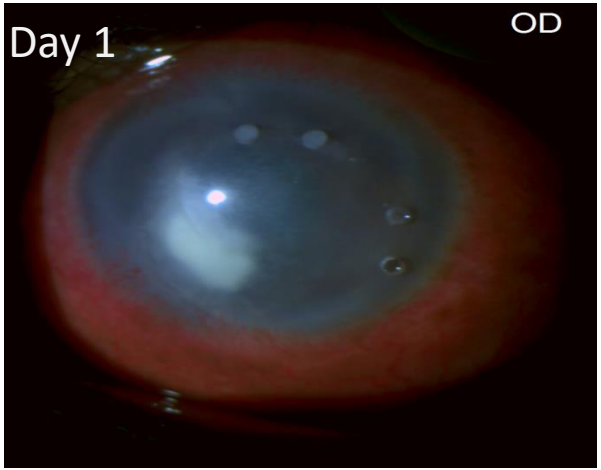


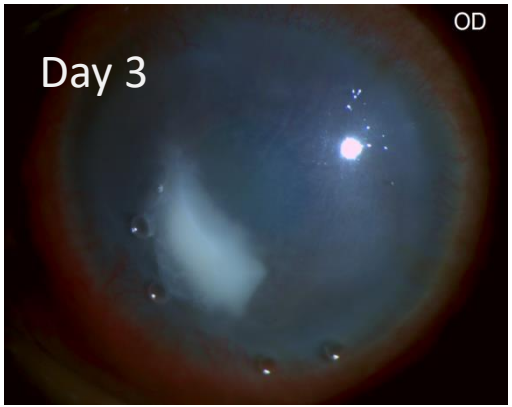
Ulcer over 3 mm, the effective healing started in 1 to 3 days and resolved by 14 days

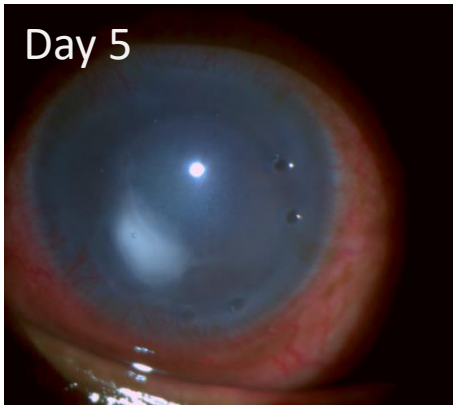
Category -2 (Over 3mm) – Case Ex. -2

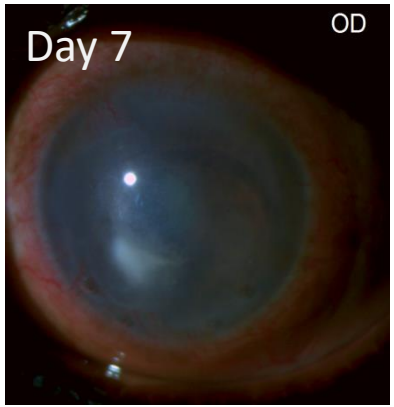


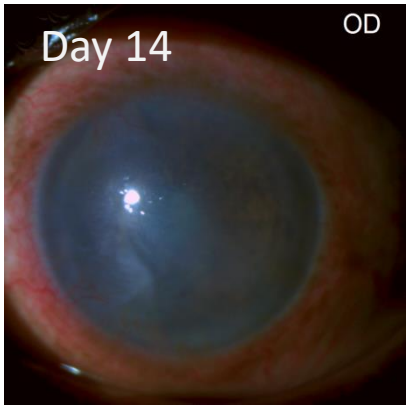






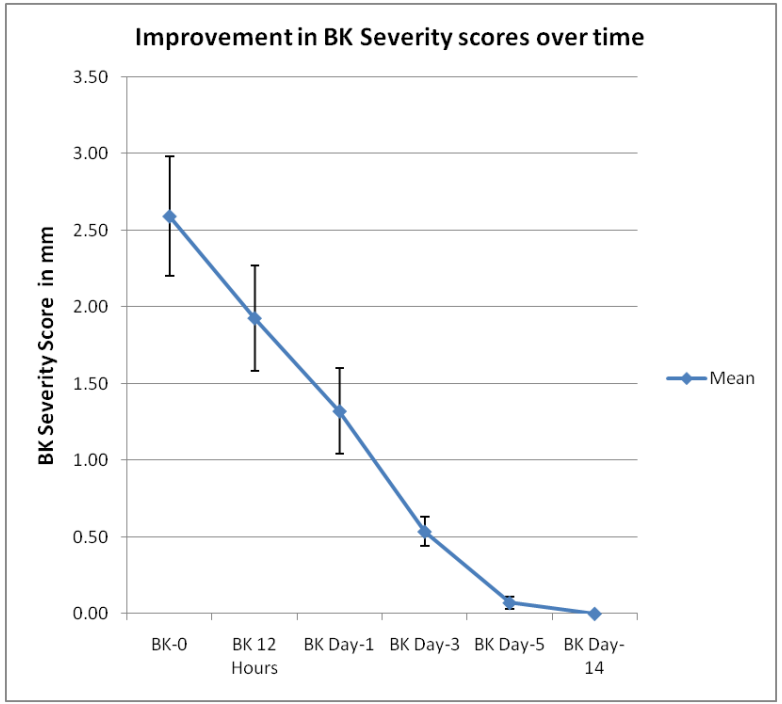






Improvement in Bacterial Keratitis Scores along timeline

BK- Improvement Score	Mean Improvement in mm	Std. Deviation
12thHr	0.66	0.28
1st Day	1.27	0.31
3rd Day	2.06	0.36
5th Day	2.52	0.35
14th Day	2.59	0.39



The mean corneal infiltration (Bacterial Keratitis Severity Score) at presentation was 2.59+/-0.39 mm

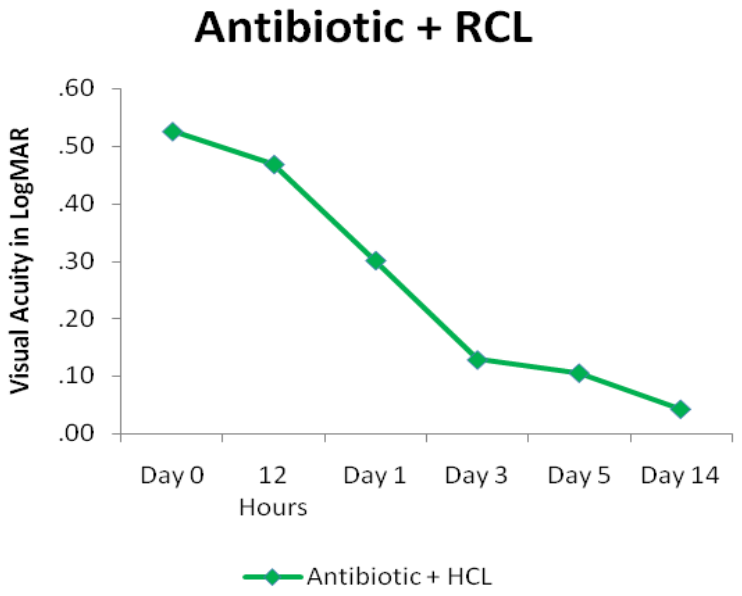
The average resolution of infiltration by 12 hours was 0.66 mm

The same by Day 1 was 1.27 mm, Day 3 was 2.06,

Day 5 was 2.52 mm and were completely healed by 2 weeks

Improvement in Visual Acuity along timeline

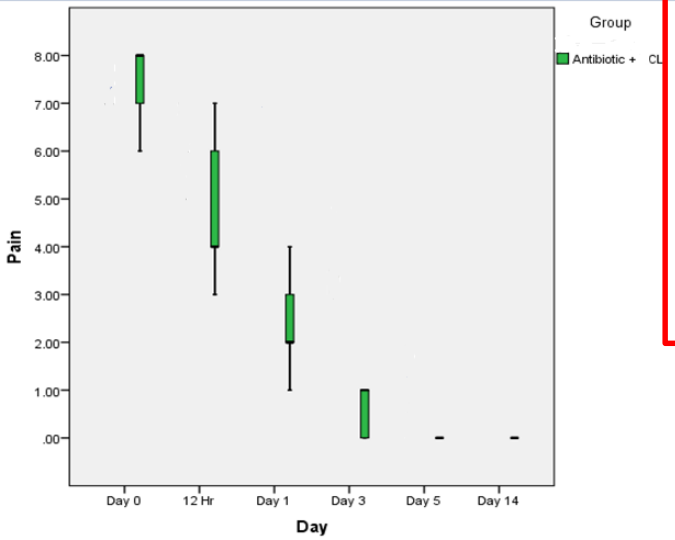
		Mean	Std. Deviation	P value
Pair 1	0	0.53	0.31	0.101
	12	0.47	0.32	
Pair 2	0	0.53	0.31	**0.003**
	Day 1	0.30	0.35	
Pair 3	0	0.53	0.31	0.001
	Day 3	0.13	0.24	
Pair 4	0	0.53	0.31	0.002
	Day 5	0.11	0.19	
Pair 5	0	0.53	0.31	0.007
	Day 14	0.04	0.11	



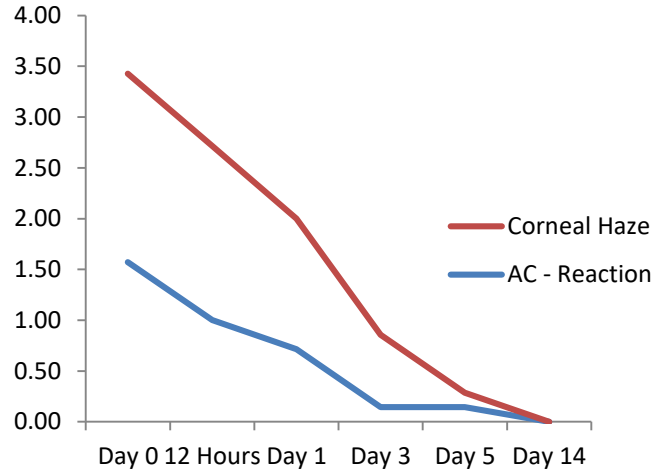
A mean of 1.5 line improvement in vision was noticed by Day 1 which improved by another line by Day 3

Changes in Pain, AC reaction And Corneal-Haze over time

Pain Score	Group	Mean Pain	Std. Deviation
	Day 0	7.43	0.79
	12H	4.71	1.70
	Day 1	2.14	1.07
	Day 3	0.57	0.53
	Day 5	0.00	0.00
	Day 14	0.00	0.00

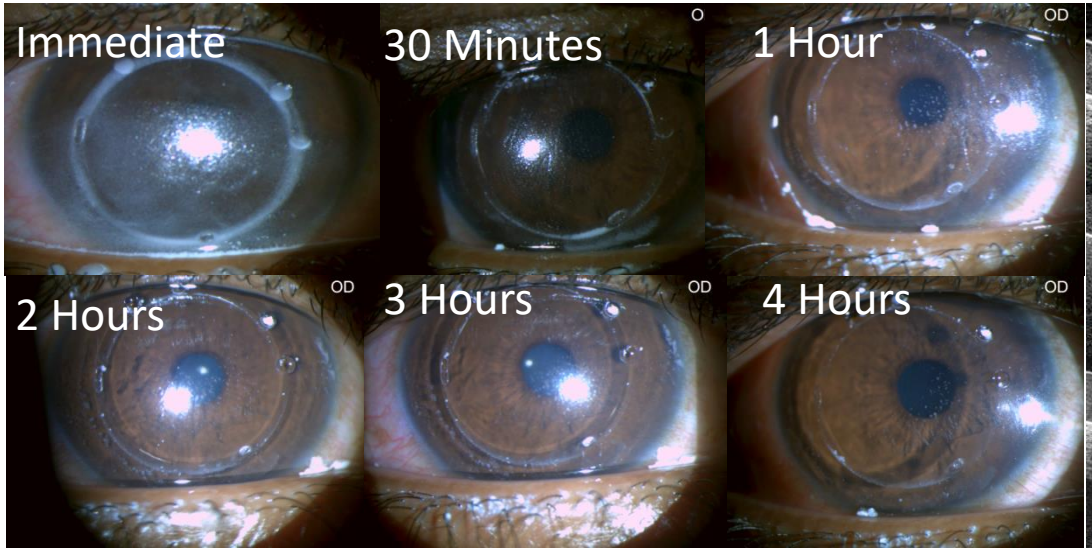


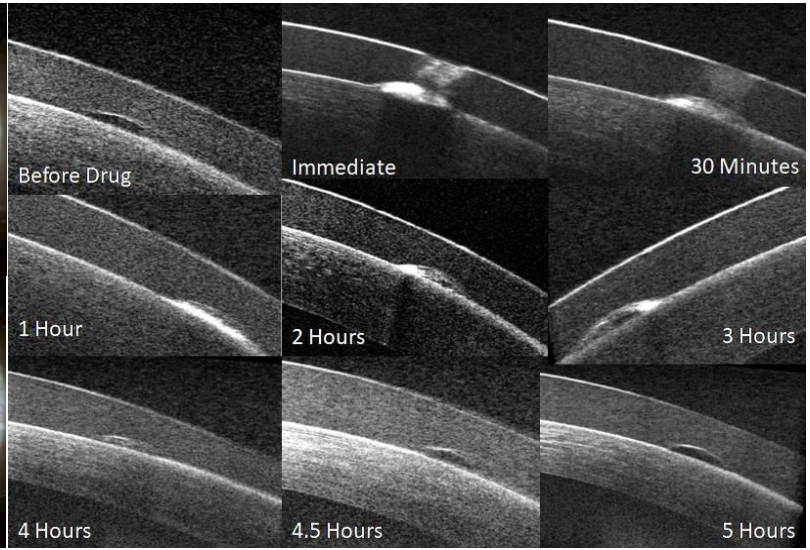
The mean presenting pain scores were 7.43+/- 0.79. Reduced by 2.72 points at 12 Hours, by 5.29 points at 1 Day ($p<0.001$), by 6.86 points at 3 days ($p<0.001$).



A significant reduction in AC reaction & improvements in Corneal Haze was noticed with-in the first 3 days

Drug Retention Studies





Drug retention over time curve studies, using triamcinolone acetonide reflected drug availability in the central reservoir, peaking immediately on instillation and detected in the potential pre corneal space up to a period 4 hours, thus favoring an extended drug-corneal contact time

* Triamcinolone used to stain vitreous without staining the IOL during cataract surgery, is used as a testing agent in this study

- Poor drug bioavailability is a major concern associated with ocular dosage forms
- We in our study aimed in retaining the drug in the pre-corneal space, by using a very highly specified Depo-CL with dual base curves which resulted in a central antimicrobial lake for drug retention properties rather than the sustained release properties.
- Also, the fenestrations in the lens enabled the capture of every time applied topical antimicrobial to refill the central reservoir with the drug for a prolonged corneal contact time.
- Resolution of corneal infiltration was observed significantly before the 3rd day & we recommend that the treating physicians may remove Lens after a significant clinical healing response is noticed preferably after 3 days
- We noted a significant reduction in pain by 12 hours of treatment
- Our study reported no treatment-emergent adverse events
- Further studies may be evaluated with larger cohorts, comparison of large-sized ulcer groups, studies aiming reduced frequency of topical applications, and extension of this management strategy for protozoal and mycotic keratitis which requires longer drug-lesion contact periods than bacterial keratitis.

CONCLUSIONS:

- The Drug Repository Contact Lenses may be indicated for therapeutic use to promote effective corneal healing and pain relief during the treatment of bacterial keratitis.
- The concept of using novel drug repository contact lens over the lesion is effective in prolonging corneal antimicrobial availability, which can affect the overall outcomes in bacterial keratitis.
- Employing a drug-depo contact lens may reduce the regimen of antibiotics, decrease treatment burden on the medical staff, improve patient tolerance, reduce drug toxicities, and may change present practice patterns.