To compare the Higher Order Aberrations, Point Spread Function (PSF), Modular Transfer Function (MTF) and Contrast Sensitivity (CS) in eyes with pre and post Scleral Contact Lens (ScCL) wear in cases of Advanced Irregular Cornea

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Purpose

1. Comparing Total Root mean square Higher Order Aberrations (rms HOA), Point spread Function and Modular Transfer Function in eyes between pre and on eye Scleral Contact Lens (ScCL) wear in cases of advanced Irregular cornea using wave-front aberrometry.
2. To compare Contrast Sensitivity with and without ScCL on eye in cases of irregular advanced cornea.

Inclusion Criteria

1. Patients having advanced irregular cornea fitted with Scleral Contact Lens were included.
2. Patient willing for consent and to participate in study were included.
3. Patient with other ocular morbidities were excluded.
4. Patient having poor fixation were excluded.
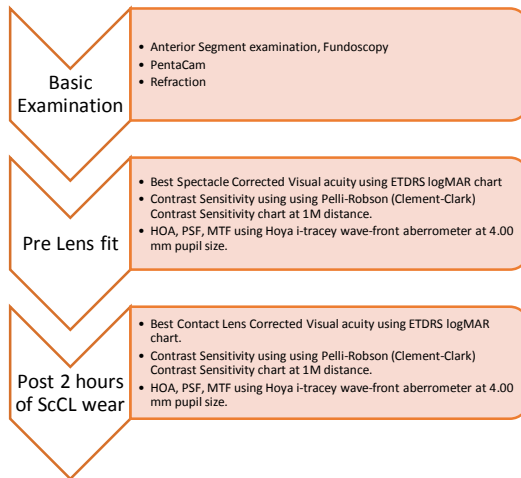5. Patient using other contact lens system were excluded.

Demographic Details

1. Twenty One eyes of 21 patients were analyzed.
2. Four eyes having pellucid marginal degeneration, 5 having post refractive surgery ectasia and 12 having advanced keratoconus
3. Mean age : 22 ± 9 years (Male - 13 Female -8)
4. The mean logMAR spectacle corrected visual acuity was 0.49 ± 0.29 and Mean logMAR Contact lens Corrected visual acuity were 0.18 ± 0.22

Materials

1. Institutional Ethics and informed consent was obtained prior study.
2. Study Design : Prospective Comparative Observational Study.
3. Study Sample : Patients with Advanced Irregular Corneas reporting to contact lens clinic for visual rehabilitation.
4. HOA, PSF and MTF was measured using i-Tracey wave-front aberrometer.
5. Contrast sensitivity was measured using Pelli-Robson (Clement-Clark) Contrast Sensitivity chart
6. Details of all patients were recorded on a pre designed proforma.
7. Corneal Topography (Pentacam) and ocular surface were evaluated to check the suitability of Contact Lens on eye.

Methodology

Basic Examination
- Anterior Segment examination, Fundoscopy
- PentaCam
- Refraction

Pre Lens fit
- Best Spectacle Corrected Visual acuity using ETDRS logMAR chart
- Contrast Sensitivity using using Pelli-Robson (Clement-Clark) Contrast Sensitivity chart at 1M distance.
- HOA, PSF, MTF using Hoya i-tracey wave-front aberrometer at 4.00 mm pupil size.

Post 2 hours of ScCL wear
- Best Contact Lens Corrected Visual acuity using ETDRS logMAR chart.
- Contrast Sensitivity using using Pelli-Robson (Clement-Clark) Contrast Sensitivity chart at 1M distance.
- HOA, PSF, MTF using Hoya i-tracey wave-front aberrometer at 4.00 mm pupil size.

Results

1. With prescribed and dispensed ScCL, significant improvement in quality of vision (Mean logMAR Contact lens Corrected visual acuity: 0.18 ± 0.22) was noted.
2. There was significant improvement in contrast sensitivity as pre ScCL wear mean Contrast Sensitivity was 0.41 ± 0.47 whereas mean contrast sensitivity post ScCL lens wear was 1.44 ± 0.17.
3. The magnitude of total HO-RMS aberration, coma, trefoil and spherical aberration were reduced significantly.
4. The "p" values showed high statistically significant improvements in VA, CS, HO aberrations, PSF and MTF.

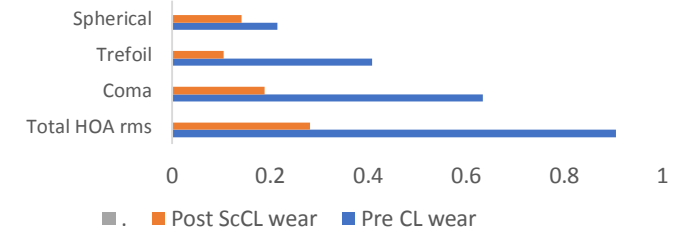### Graph Depicting Comparison between Pre & on eye ScCL wear Abberations

Legend: Post ScCL wear / Pre CL wear (categories: Spherical, Trefoil, Coma, Total HOA rms)

Table showing wavefront aberrometry outcomes in pre and on eye ScCL wear

Parameters	Pre Lens wear	Post CL wear	P value
HOA RMS (μ)	0.906 ± 0.711	0.282 ± 0.157	<0.001
TREFOIL (μ)	0.408 ± 0.305	0.105 ± 0.049	<0.001
COMA (μ)	0.634 ± 0.558	0.189 ± 0.125	<0.001
SPHERICAL (μ)	0.215 ± 0.330	0.142 ± 0.028	<0.001
PSF (Strehl Ratio)	0.00968 ± 0.00798	0.09895 ± 0.113639	0.0009
MTF	0.114 ± 0.045	0.236 ± 0.142	0.0006

Figure depicting comparison in aberrometry outcomes in pre (Right) and on eye ScCL wear (Left)
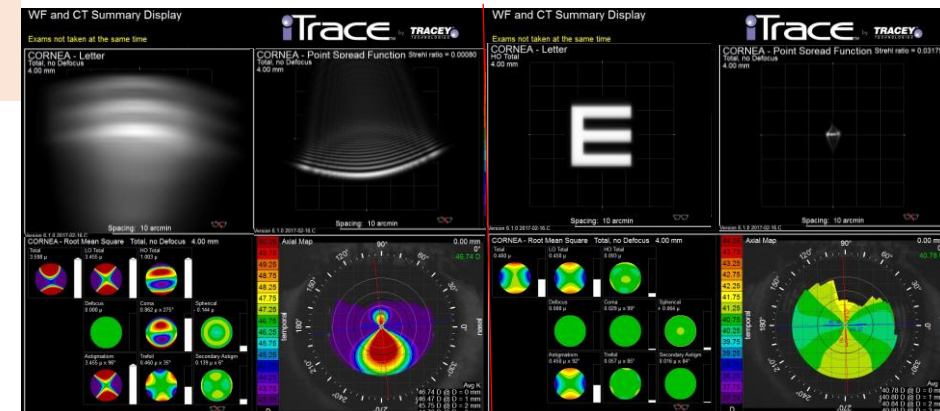
Conclusion: Scleral contact lenses play a very important role in not only improving vision but also help in increasing visual functions by enhancing contrast sensitivity and reducing high order ocular aberrations. MTF and PSF in i-tracey act as indicators for the visual quality of a patient by generating a simulated image. Irregularity is managed in ectatic corneas by ScCL due to their large optical zone and neutralized by tear vault.