

# ECLSO 2026 CONGRESS

The European Society of Contact Lenses and Ocular Surface

## How Do Scleral Contact Lenses Influence OCT Parameters in Keratoconus?



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### Introduction

Keratoconus causes irregular astigmatism and reduced visual quality. Scleral contact lenses (SCLs) restore optical regularity by creating a tear reservoir. OCT imaging is essential for structural evaluation. Irregular optics may compromise OCT image quality and reliability.

### Purpose

The present study aims to investigate how SCLs affect OCT scan quality and structural measurements—particularly corneal thickness, epithelial thickness, ganglion cell-inner plexiform layer (GCIPL) thickness, and retinal nerve fiber layer (RNFL) thickness—in keratoconus patients.

### Methods

This retrospective observational study included 28 eyes of 28 KC patients. All participants underwent a comprehensive ophthalmologic evaluation, including corneal topography and spectral-domain OCT (Optopol REVO 60). Two OCT measurement sessions were performed on the same day: one without SCLs and one after a 30–75 min adaptation period with Mini Misa® SCLs. Recorded parameters included corneal and epithelial thicknesses, GCIPL thickness, RNFL thickness, and device-reported QI. Correlation analyses between topographic values, age, and OCT parameters were also conducted.

### Results

The mean age of participants was 32.96±13.72 years. SCL wear significantly decreased anterior segment QI (6.76±1.73 vs. 5.57±2.34, p=0.019) but improved posterior segment QI in both the ganglion (2.52±1.03 vs. 5.76±2.17, p<0.001) and disc (2.82±0.94 vs. 4.39±1.87, p<0.001) modules. Central corneal thickness remained stable, while central epithelial thickness decreased slightly (50.53±6.66 μm vs. 47.59±7.20 μm, p=0.007). RNFL and GCIPL thicknesses showed no significant changes, except for minor sectoral variations. Steeper keratometry values correlated with lower QI in both conditions.

### Discussion

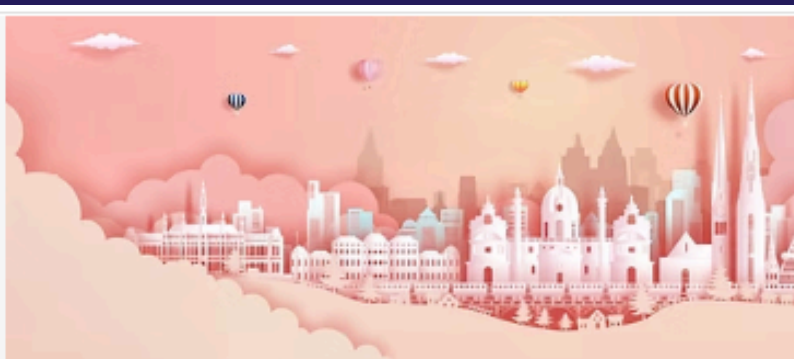
The current literature has mainly focused on the effects of soft contact lenses on OCT image quality, particularly in healthy individuals, while data on scleral contact lenses (SCLs) in keratoconus remain limited. Previous studies have shown that rigid lenses can improve OCT signal quality and retinal measurements by correcting irregular astigmatism. In addition, macular parameters appear to be relatively stable despite optical irregularities. Similarly, in our study, GCIPL thickness remained largely unchanged between lens-off and lens-on conditions, with only minor sectoral variations observed.

### Conclusions

Scleral lenses significantly improve posterior OCT image quality.  
They do not alter key retinal measurements.  
This means OCT results remain reliable during lens wear.  
Anterior segment quality may slightly decrease.  
Scleral lenses provide both visual and diagnostic advantages.

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## How Do Scleral Contact Lenses Influence OCT Parameters in Keratoconus?

Table 1. Changes in OCT measurements with and without scleral contact lenses.

	Mean ± SD			P
	Without Lenses (n = 28)	With Lenses (n = 28)	Difference (n = 28)	
<b>Anterior segment analysis</b>				
QI	6.76 ± 1.73	5.57 ± 2.34	-1.19 ± 2.14	0.019 <sup>1</sup>
Corneal thickness (µm)				
Central	431.05 ± 50.73	431.05 ± 55.28	0.0 ± 9.52	0.794 <sup>2</sup>
Maximum	512.29 ± 41.08	510.35 ± 41.14	-1.94 ± 20.01	0.894 <sup>1</sup>
Minimum	392.81 ± 56.34	382.95 ± 73.49	-9.86 ± 30.76	0.643 <sup>2</sup>
Epithelial thickness (µm)				
Central	50.53 ± 6.66	47.59 ± 7.2	-2.94 ± 3.65	0.007 <sup>2</sup>
Maximum	63.24 ± 10.87	62.24 ± 18.18	-1.0 ± 10.71	0.093 <sup>2</sup>
Minimum	41.65 ± 4.82	38.29 ± 4.67	-3.35 ± 3.69	0.002 <sup>1</sup>
<b>Ganglion analysis</b>				
QI	2.52 ± 1.03	5.76 ± 2.17	3.24 ± 2.05	<0.001 <sup>1</sup>
GCIPL thickness (µm)				
Average	86.59 ± 5.55	86.09 ± 4.7	-0.5 ± 1.87	0.153 <sup>2</sup>
Minimum	42.55 ± 8.86	44.84 ± 8.0	2.09 ± 8.02	0.235 <sup>1</sup>
Superior	86.77 ± 4.88	86.5 ± 4.02	-0.27 ± 2.57	0.623 <sup>1</sup>
Superior nasal	88.64 ± 6.0	88.77 ± 4.58	0.14 ± 2.55	0.884 <sup>2</sup>
Superior temporal	83.64 ± 5.62	83.59 ± 4.4	-0.05 ± 2.84	0.751 <sup>2</sup>
Inferior	87.32 ± 5.78	86.05 ± 5.72	-1.27 ± 1.45	0.001 <sup>1</sup>
Inferior nasal	88.5 ± 6.84	88.05 ± 6.28	-0.45 ± 2.3	0.14 <sup>2</sup>
Inferior temporal	85.0 ± 6.59	84.36 ± 5.6	-0.64 ± 2.04	0.158 <sup>1</sup>
<b>Disc analysis</b>				
QI	2.82 ± 0.94	4.39 ± 1.87	1.57 ± 1.85	<0.001 <sup>2</sup>
Disc area (mm <sup>2</sup> )	2.36 ± 0.76	2.18 ± 0.55	-0.18 ± 0.64	0.25 <sup>2</sup>
Vertical C/D	0.55 ± 0.24	0.49 ± 0.23	-0.06 ± 0.21	0.167 <sup>2</sup>
RNFL thickness (µm)				
Average	93.15 ± 12.66	93.74 ± 9.51	0.59 ± 6.98	0.07 <sup>2</sup>
Superior	108.5 ± 18.33	112.71 ± 16.07	6.21 ± 10.72	0.005 <sup>1</sup>
Nasal	76.64 ± 14.6	74.5 ± 11.5	-2.14 ± 8.57	0.164 <sup>2</sup>
Inferior	118.89 ± 21.87	120.82 ± 16.47	1.93 ± 14.62	0.085 <sup>2</sup>
Temporal	68.75 ± 11.08	66.64 ± 9.95	-2.11 ± 6.31	0.024 <sup>2</sup>

OCT: optical coherence tomography, SD: standard deviation, QI: quality index, GCIPL: ganglion cell-inner plexiform layer, C/D: cup to disc ratio, RNFL: retinal nerve fiber layer. <sup>1</sup> paired t-test, <sup>2</sup> Wilcoxon signed-rank test, *p* < 0.05 marked bold.

Table 2. Correlation analysis between age, topographic values, and OCT measurements without SCLs.

	Age (Years)		K1 (D)		K2 (D)		Kmax (D)		Astigmatism (D)	
	r	p	r	p	r	p	r	p	r	p
<b>Anterior segment analysis</b>										
QI	0.301	0.152	-0.393	0.039	-0.332	0.084	-0.471	0.011	-0.12	0.544
Corneal thickness (µm)										
Central	0.072	0.738	-0.09	0.648	-0.024	0.905	0.177	0.367	0.394	0.038
Maximum	0.387	0.062	0.179	0.361	0.189	0.336	0.395	0.038	0.068	0.73
Minimum	-0.189	0.375	0.028	0.887	0.102	0.806	0.288	0.137	0.393	0.038
Epithelial thickness (µm)										
Central	0.096	0.655	-0.501	0.007	-0.483	0.009	-0.42	0.026	0.043	0.828
Maximum	0.246	0.246	-0.318	0.099	-0.388	0.041	-0.268	0.168	-0.227	0.246
Minimum	-0.1	0.641	-0.273	0.159	-0.252	0.196	-0.198	0.311	0.152	0.44
<b>Ganglion analysis</b>										
QI	-0.39	0.08	-0.328	0.109	-0.46	0.021	-0.454	0.023	0.103	0.628
GCIPL thickness (µm)										
Average	-0.41	0.052	0.078	0.7	0.1	0.62	0.159	0.427	0.278	0.161
Minimum	-0.425	0.043	-0.323	0.101	-0.271	0.172	-0.253	0.203	0.179	0.371
Superior	-0.449	0.031	0.036	0.858	0.081	0.888	0.158	0.432	0.22	0.271
Superior nasal	-0.338	0.114	-0.007	0.972	-0.027	0.894	0.052	0.797	0.161	0.424
Superior temporal	-0.432	0.039	0.121	0.548	0.141	0.484	0.182	0.364	0.302	0.125
Inferior	-0.392	0.064	0.039	0.846	0.075	0.711	0.098	0.828	0.236	0.235
Inferior nasal	-0.334	0.119	-0.055	0.784	-0.043	0.832	0.009	0.965	0.192	0.338
Inferior temporal	-0.436	0.037	0.127	0.527	0.127	0.526	0.155	0.439	0.319	0.105
<b>Disc analysis</b>										
QI	-0.371	0.075	-0.348	0.07	-0.384	0.044	-0.403	0.033	0.163	0.407
Disc area (mm <sup>2</sup> )	0.128	0.551	-0.161	0.414	0.042	0.832	-0.032	0.873	0.463	0.013
Vertical C/D	0.188	0.389	0.061	0.763	0.135	0.502	0.162	0.421	0.155	0.439
RNFL thickness (µm)										
Average	-0.277	0.2	-0.552	0.003	-0.437	0.023	-0.498	0.008	0.173	0.388
Superior	-0.142	0.508	-0.213	0.276	-0.199	0.309	-0.266	0.172	-0.131	0.507
Nasal	-0.295	0.162	-0.509	0.006	-0.351	0.067	-0.386	0.042	0.444	0.018
Inferior	-0.039	0.855	-0.449	0.017	-0.429	0.023	-0.476	0.01	-0.162	0.411
Temporal	-0.494	0.014	0.056	0.777	0.101	0.611	0.133	0.501	0.376	0.049

OCT: optical coherence tomography, SCL: scleral contact lens, D: diopter, QI: quality index, GCIPL: ganglion cell-inner plexiform layer, C/D: cup to disc ratio, RNFL: retinal nerve fiber layer. Spearman's correlation test, *p* < 0.05 marked bold.

Table 3. Correlation analysis between age, topographic values, and OCT measurements with SCLs.

	Age (Years)		K1 (D)		K2 (D)		Kmax (D)		Astigmatism (D)	
	r	p	r	p	r	p	r	p	r	p
<b>Anterior segment analysis</b>										
QI	0.344	0.163	-0.619	0.003	-0.605	0.004	-0.67	0.001	-0.409	0.066
Corneal thickness (µm)										
Central	0.359	0.143	0.055	0.814	0.154	0.505	0.276	0.227	0.343	0.129
Maximum	0.513	0.061	-0.042	0.874	0.171	0.512	0.366	0.149	0.47	0.057
Minimum	0.038	0.88	0.247	0.281	0.379	0.09	0.496	0.022	0.444	0.044
Epithelial thickness (µm)										
Central	0.741	0.002	-0.605	0.01	-0.618	0.009	-0.483	0.05	-0.177	0.496
Maximum	0.798	0.001	-0.481	0.05	-0.623	0.008	-0.4	0.112	-0.352	0.166
Minimum	-0.162	0.58	0.007	0.978	0.185	0.528	0.287	0.284	0.196	0.451
<b>Ganglion analysis</b>										
QI	-0.308	0.214	0.397	0.068	0.352	0.108	0.327	0.137	0.238	0.286
GCIPL thickness (µm)										
Average	-0.366	0.135	0.254	0.253	0.205	0.361	0.348	0.113	0.195	0.385
Minimum	-0.371	0.13	0.088	0.698	0.025	0.912	0.117	0.604	0.187	0.347
Superior	-0.233	0.352	0.274	0.217	0.24	0.283	0.348	0.113	0.138	0.54
Superior nasal	-0.289	0.246	0.216	0.334	0.146	0.516	0.255	0.252	0.049	0.827
Superior temporal	-0.211	0.401	0.234	0.295	0.146	0.51	0.236	0.29	0.109	0.628
Inferior	-0.359	0.143	0.19	0.396	0.203	0.364	0.33	0.134	0.267	0.23
Inferior nasal	-0.382	0.118	0.06	0.792	0.039	0.894	0.216	0.335	0.183	0.469
Inferior temporal	-0.348	0.157	0.291	0.189	0.171	0.447	0.329	0.135	0.151	0.502
<b>Disc analysis</b>										
QI	-0.513	0.01	0.013	0.946	0.058	0.789	0.05	0.8	0.414	0.028
Disc area (mm <sup>2</sup> )	0.047	0.829	-0.444	0.018	-0.298	0.124	-0.257	0.187	0.35	0.088
Vertical C/D	0.343	0.109	-0.095	0.838	-0.062	0.757	-0.053	0.794	-0.043	0.831
RNFL thickness (µm)										
Average	-0.307	0.145	-0.513	0.005	-0.402	0.034	-0.423	0.025	0.236	0.226
Superior	-0.45	0.027	-0.112	0.57	-0.037	0.851	-0.05	0.802	0.154	0.433
Nasal	-0.133	0.535	-0.578	0.001	-0.371	0.052	-0.425	0.024	0.504	0.006
Inferior	-0.146	0.495	-0.231	0.237	-0.217	0.287	-0.29	0.134	-0.059	0.765
Temporal	-0.263	0.214	0.13	0.51	0.111	0.574	0.186	0.397	0.221	0.259

OCT: optical coherence tomography, SCL: scleral contact lens, D: diopter, QI: quality index, GCIPL: ganglion cell-inner plexiform layer, C/D: cup to disc ratio, RNFL: retinal nerve fiber layer. Spearman's correlation test, *p* < 0.05 marked bold.

