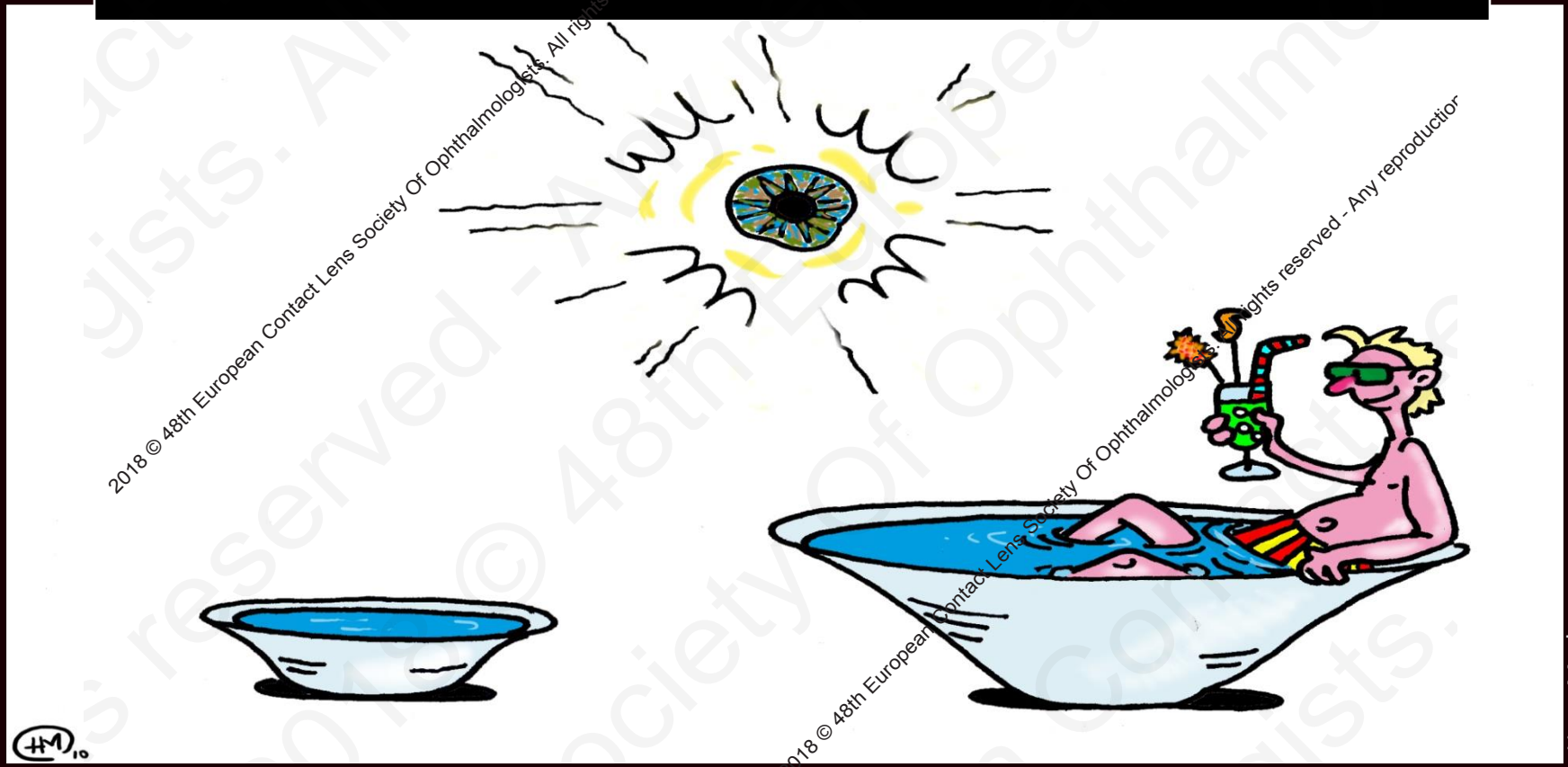
Scleral Lens Controversies

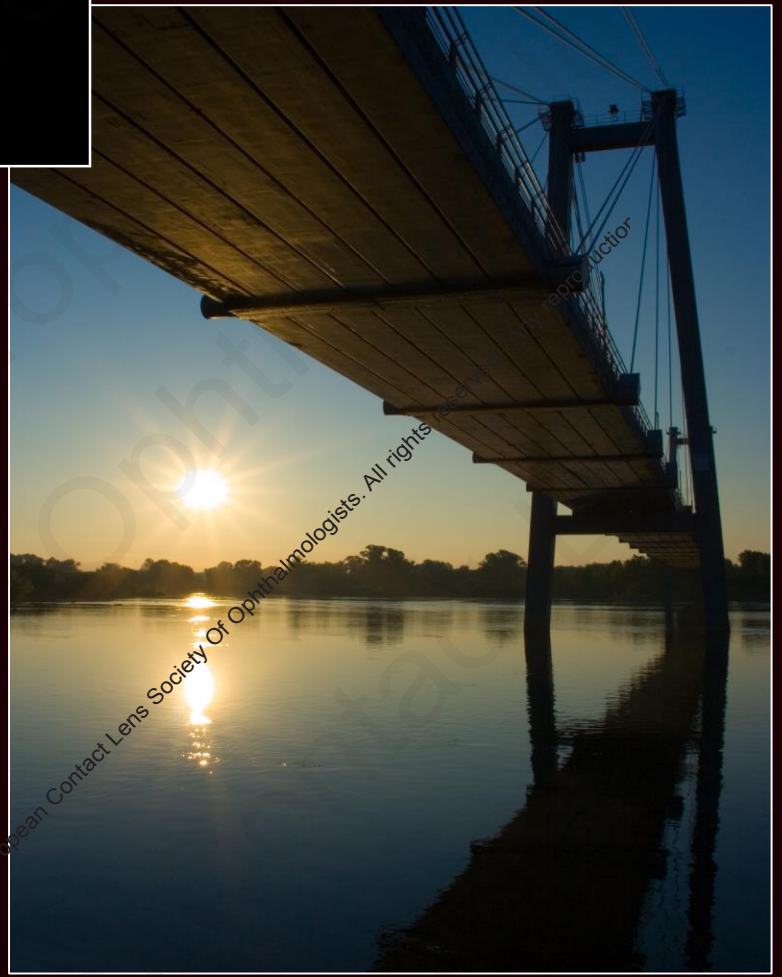


Hans Mader

Disclosures

- Alcon/CIBA vision, Allergan/Abbott, Bausch & Lomb Boston, Contamac, Coopervision, David Thomas, Ercon, Eyescan, Hecht, Johhson & Johnson, Microlens, NKL, Paragon Vision, Procornea, Soflex, Truform, Ultravision, Valley contacts, X-Cel
- Research Grant: Eaglet Eye – Eye Surface Profiler
- Educational Grant: B+L Boston – Scleral Lens Guide
- Educational Grant: NKL – The Learning Curve (book)
- Educational Grant: Contamac Ltd – generic specialty lens education

Scleral Lenses



Scleral Lens Controversies

LENS HANDLING

Scleral Lens Controversies

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Editorial

Scleral lenses (are) special

In previous editorials [1,2] editor-in-chief of this journal Shehzad Naroo has suggested that in specialty contact lens fitting it was the practitioner that was special, or that a lens was only special in certain circumstances. In case of scleral lens fitting there is not much of a debate: even within the specialty lens profession, scleral lenses are regarded as a sub-speciality.

However, indications for scleral lens fitting have been evolving over the last few years, emerging from a lens type for severely irregular corneas only, to a much broader spectrum of indications. Scleral lenses that have their resting point beyond the corneal borders are believed to be among the best vision correction options for irregular corneas; they can postpone or even prevent surgical intervention as well as decrease the risk of corneal scarring. For true clearance of the cornea without any mechanical involvement, it is advisable to avoid any contact between the lens and the cornea by bridging over it.

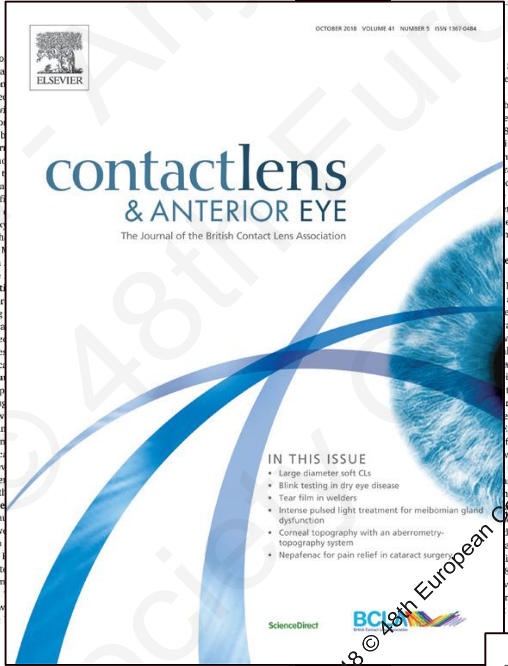
About 10 years ago, only a handful of very specialised lens fitters around the world were capable of fitting scleral lenses successfully, and only a few manufacturers were making scleral lenses. Now, many contact lens manufacturers have scleral lens designs in their arsenal. Improved manufacturing processes allow for better design, make lenses more reproducible and decrease costs, which combined with enhanced lens materials have contributed to improved ocular health, longer wearing time and ease of lens fit. Specialist contact lenses seem to be the fastest segment of the contact lens market.

The late '60s and early '70s of last century showed a small spike of publications in the peer reviewed journals on scleral lenses, but that is nothing compared to the recent surge of scientific publications on the topic [3]. Countless articles have been published on indications for scleral lenses and their benefits, which are most profound in visual performance improvement and/or comfort as compared to corneal lenses. Generally, quality of life can be increased, quite dramatically in some cases, with scleral lenses. As Jan Bergmanson et al. stated it in a previous editorial of Contact Lens & Anterior Eye: '*Scleral gas permeable lenses have come of age*' [4].

Whilst we know now that they do work, and with a track record that goes back a few decades since the first gas permeable scleral lenses were introduced in the '80s of last century, there is a demand now for more knowledge about their absolute safety and convenience. Before opening up the scleral lens modality to an even broader group of patients – or even to uncompromised eyes – such knowledge is not only desired but it is imperative.

Contact Lens & Anterior Eye is therefore requesting submissions for a scleral lens special edition to be hosted in the December issue of the journal in 2018. As stated, more than showing the benefits of scleral lenses, we are looking for manuscript submissions in the scleral lens

http://dx.doi.org/10.1016/j.clae.2017.07.006



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Editorial

Scleral lenses: History & future

Scleral lens safety

It has often been queried as to how safe glass scleral lenses would be. The mentioned history chapter refers to a book by Treissman and Plaice from 1946, which recounts an apparently much-quoted case of a Zeppelin pilot who had fallen from his airship and was killed on hitting the ground. Although his body, and particularly his head, were extremely damaged in the fall, the Zeiss scleral lenses he was wearing were eventually recovered and found to be intact. Another question that is always at the forefront in scleral lens practices is how to avoid air bubbles. Müller attempted to avoid bubbles by inserting the lenses under water. Although in itself not a bad idea, this created limited lens tolerance. The discomfort experienced by Müller due to the hypotonicity of the liquid behind the lens led him to use cocaine eye drops prior to lens insertion. However, the toxicity of cocaine to the cornea did not help much and added the risk of addiction. To overcome some of the problems with solutions, Henri Dor, an ophthalmologist in Lyons, France, in 1892 recommended the use of physiological saline solution to insert scleral lenses, which is still recommended today.

Scleral lenses from the heart

One of the nicest features of the Contemporary Scleral Lenses book may be the prologue, with the four scleral lens pioneers, Donald Ezekiel, Reints Visser, Ken Pullum and Perry Rosenthal each introducing the book. Sadly enough, Perry Rosenthal passed away on March 3rd 2018 (please see obituary on pages [xx-xx], 10.1016/j.clae.2018.04.001).

The compassion of the scleral lens pioneers is contagious, and their expertise is beyond question. Rients Visser stated that 'The process of fitting scleral lenses requires more than simply using your hands and your head; you also need to use your heart.' Fitting scleral lenses is more than fitting a device - you are changing people's lives. That may require creative thinking at times, and extra guidance and assistance if needed. Also, Ken Pullum and Perry Rosenthal provide their special and personal look at scleral lenses. Don Ezekiel recalls that 'Getting the materials was the first hurdle. The hardest hurdle to overcome was assuring practitioners to understand that fitting scleral lenses was not difficult'. It is often a much needed and the only lens option for patients to obtain optimal vision with all day wearing comfort. This book certainly will contribute to better understanding and acceptance of scleral lenses worldwide.

Eef van der Worp, Melissa Barnett, Lynette Johns

Practitioner Learning Curve in Fitting Mini-Scleral Contact Lenses in Irregular and Regular Corneas using a Fitting Trial

[1]Rute J. Macedo-de-Araújo, [2]Eef van der Worp, [1]Ana Amorim-de-Sousa [1]José M. González-Méijome

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Global Specialty Lens Symposium

Introduction

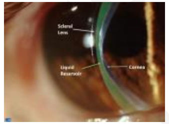

Figure 1. Schematic image of a ScCL covering an irregular cornea. Notice the liquid reservoir promoted by this lens which covers the entire cornea without touching it.

There is increasing evidence that scleral supported rigid gas permeable contact lenses (Figure 1) are suitable to compensate a wide range of corneal conditions derived from primary corneal disease, post-surgical complications and even in normal corneas. (1-3) The recent rebirth of scleral contact lens (ScCL) has been accompanied by a more predictable fitting process, but there is still a significant degree of uncertainty due to the few clinical available devices for objective measure anatomical features of the ocular surface beyond the corneal borders.

Fitting recommendations given by several manufacturers use to consider only the clinical features and the degree of severity of the corneal condition to decide the starting point for fitting. Few studies however report the success rate of the fitting process.

Purpose: To assess the learning curve of a novel practitioner with minor previous experience with ScCL fitting in the initial 156 consecutive scleral contact lenses fittings in irregular and regular corneas using a fitting trial.

Methods

Results

Number of Trial Lenses (Figure 2)

- The average number of trial lens per eye was 1.85±0.71 (1.84±0.69 on Irregular Corneas Group and 1.88±0.77 for Regular Corneas Group, with a range between 1 and 4 lenses per eye in both groups). There were no statistical significant differences between groups (p=0.970);
- There was a decrease in the number of trial lenses: from 2.35±0.18 lenses in the first 20 fittings to 1.56±013 in the last 20 fittings (p<0.05);
- After fitting number 60, the mean number of lenses began to be statistically significant lower than the first 20 fittings (p<0.05);

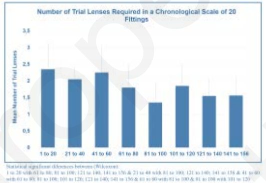

Figure 2. Mean number of trial lenses required to achieve the best fit. Data is in a chronological scale of 20 fittings.

Number of Re-orders (Figure 3)

- The average number of re-orders was 0.76±0.77, being 0.73±0.07 (range 0 to 4 lenses) on Irregular Corneas Group and 0.88±0.14 (range 0 to 3 lenses) on Regular Corneas Group. There were no statistical significant differences between groups (p=0.303);
- There was a decrease of almost 1 re-order per eye, from 0.95±0.17 in the first fittings to 0.25±0.11 in the last fittings (p<0.05);
- After fitting number 60, the mean number of re-orders began to be statically different than the first 20 fittings (p<0.05, Wilcoxon);

Discussion

Many experts mention the steep learning curve in fitting ScCLs, however there are no peer-reviewed publications on this theme. Studies with corneal RGP report the need of 1 to 5 lenses, with a mean of 2.3(4) and 1.73(5) trial lenses per eye to achieve the best fit. According to our results, a mild-experienced ScCL fitter will need less trial lenses (1.50 on average), with a reduction of 1 trial lens per eye with experience, that could mean also a chair-time reduction.

Regarding the re-orders, we found a 40% optimal fit rate in the first lens ordered – with RGPs, others have reported 77%(4) and 33%(6).

Regarding the prescribing pattern of toric landing zone lenses, it could be challenging to prove that the augment in the number of fittings with this design is a change in the practitioner skills, since those subjects with toric scleras could present at any time during clinical trials.

The trends shown in this study could be affected by asymmetry of more challenging or easier to fit cases that might appear at any time during the course of the study. However, the large sample recruited and uniformity in inclusion and exclusion criteria should contribute to a uniform distribution of cases with different degrees of difficulty.

Conclusions

Approximately 60 cases were required before obtaining a significant reduction in the trial lenses and re-orders necessary. Also, there is a trend towards using toric designs more frequently.

financial interest in the brands and materials mentioned.

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Relationship of placido corneal topography data with scleral lens fitting parameters

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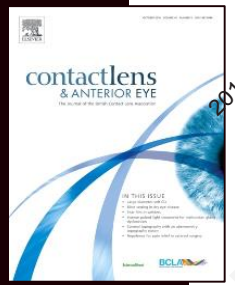

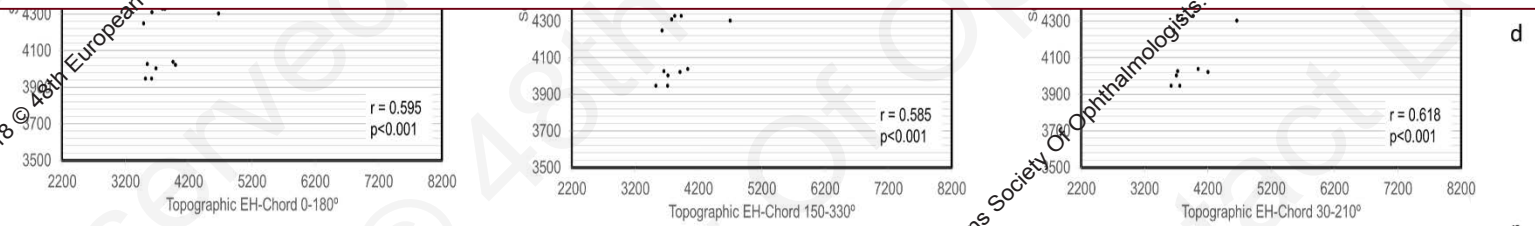

*Estimated Height (EHChord) = scleral lens projected diameter

* Vault – Cornea-lens separation

OC_SAG @ 10mm

OC_SAG @ 12mm

ScCL_SAG

…further reduction in the trial lenses and re-orders necessary?

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Contact Lens and Anterior Eye

journal homepage: www.elsevier.com/locate/clae

The time course and nature of corneal oedema during sealed miniscleral contact lens wear

Scleral lens induced corneal oedema is stromal in nature. On average, central stromal and total corneal thickness increased rapidly following lens insertion and peaked after 90 min.

Corneal changes following short-term miniscleral contact lens wear

Modern miniscleral contact lenses that vault the cornea may slightly influence corneal shape and power but do not induce clinically significant corneal oedema during short-term wear.

The influence of centre thickness on miniscleral lens flexure

When intentionally reducing scleral lens centre thickness to enhance oxygen transmissibility, customised back surface designs may be required to minimise in-vivo flexure in eyes with > 200 µm scleral toricity at a 15 mm chord.

Contents lists available at ScienceDirect

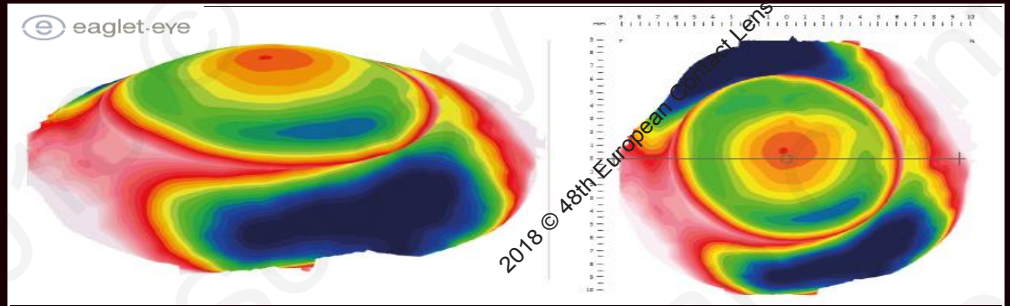
Contact Lens and Anterior Eye

journal homepage: www.elsevier.com/locate/clae

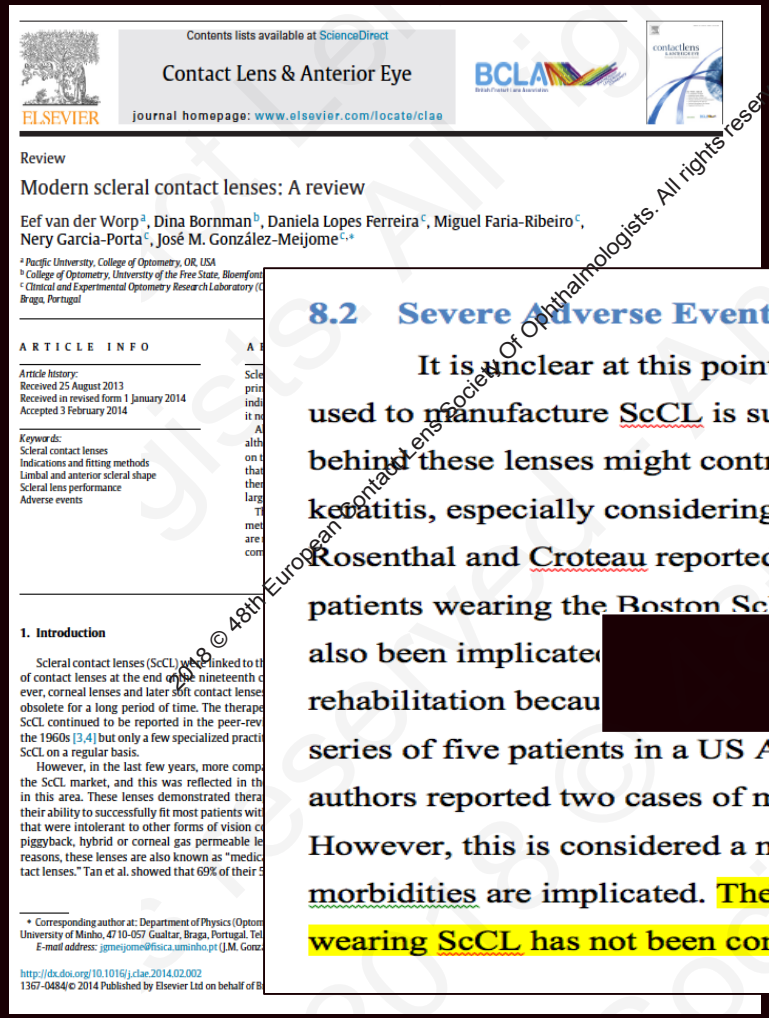
Anterior eye surface changes following miniscleral contact lens wear

Alejandra Consejo[a,b,c], Joséphine Behaegel[c,d], Maarten Van Hoey[a], James S. Wolffsohn[e], Jos J. Rozema[a,c], D. Robert Iskander[b]

Short-term miniscleral contact lens wear in healthy eyes does not produce significant corneal shape changes measured with profilometry but alters sclero-conjuctival topography……. sclero-conjuctival flattening was not uniformly distributed across the anterior eye.



COMPLICATIONS



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Contact Lens & Anterior Eye

journal homepage: www.elsevier.com/locate/clae

Review

Modern scleral contact lenses: A review

Eef van der Worp[a], Dina Bornman[b], Daniela Lopes Ferreira[c], Miguel Faria-Ribeiro[c], Nery Garcia-Porta[c], José M. González-Meijome[c,*]

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Indications and fitting methods
Limbal and anterior scleral shape
Scleral lens performance
Adverse events

1. Introduction

Scleral contact lenses (ScCL) are linked to th
of contact lenses at the end of the nineteenth c
ever, corneal lenses and later soft contact lense
obsolete for a long period of time. The therape
ScCL continued to be reported in the peer-rev
the 1960s [3,4] but only a few specialized practi
ScCl on a regular basis.

However, in the last few years, more compa
the ScCL market, and this was reflected in th
in this area. These lenses demonstrated thera
their ability to successfully fit most patients wit
that were intolerant to other forms of vision c
piggyback, hybrid or corneal gas permeable le
reasons, these lenses are also known as "medic
tact lenses." Tan et al. showed that 69% of their 5

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1367-0484/

8.2 Severe Adverse Events

It is unclear at this point whether the oxygen permeability of current materials used to manufacture ScCL is sufficient (see section 4.2). In addition, the tear stagnation behind these lenses might contribute to higher rates of adverse events such as microbial keratitis, especially considering the already compromised status of most of the corneas. Rosenthal and Croteau reported the occurrence of four cases of microbial keratitis in patients wearing the Boston Scleral lens on an extended wear basis.[7] Compliance has also been implicated

rehabilitation becau

series of five patients in a US Army burn unit who suffered severe ocular burns, the authors reported two cases of microbial keratitis related to *Pseudomonas* and MRSA.[50] However, this is considered a non-standard situation in which many other co-morbidities are implicated. The occurrence of adverse reactions in uncompromised eyes wearing ScCL has not been commonly reported in the peer-review literature.

MICROBIAL KERATITIS

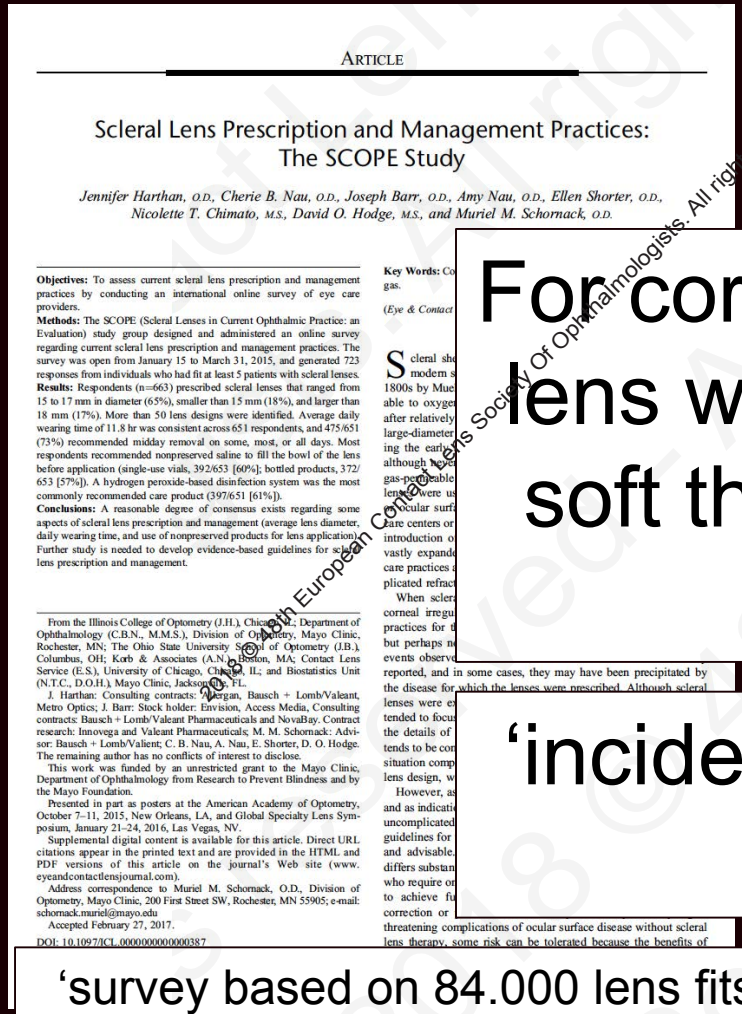
COMPLICATIONS

MICROBIAL KERATITIS

For corneal GPs this is 1 on 10.000 lens wear years (0.01%)’. For DW soft this is 5 on 10.000 lens wear years (0.05%)’.

‘incidence’ van 0.1% for infections with scleral lenses.

‘survey based on 84.000 lens fits’



ARTICLE

Scleral Lens Prescription and Management Practices: The SCOPE Study

Jennifer Harthan, O.D., Cherie B. Nau, O.D., Joseph Barr, O.D., Amy Nau, O.D., Ellen Shorter, O.D., Nicolette T. Chimato, M.S., David O. Hodge, M.S., and Muriel M. Schornack, O.D.

Objectives: To assess current scleral lens prescription and management practices by conducting an international online survey of eye care providers.

Methods: The SCOPE (Scleral Lenses in Current Ophthalmic Practice: an Evaluation) study group designed and administered an online survey regarding current scleral lens prescription and management practices. The survey was open from January 15 to March 31, 2015, and generated 723 responses from individuals who had fit at least 5 patients with scleral lenses.

Results: Respondents (n=663) prescribed scleral lenses that ranged from 15 to 17 mm in diameter (65%), smaller than 15 mm (18%), and larger than 18 mm (17%). More than 50 lens designs were identified. Average daily wearing time of 11.8 hr was consistent across 651 respondents, and 475/651 (73%) recommended midday removal on some, most, or all days. Most respondents recommended nonpreserved saline to fill the bowl of the lens before application (single-use vials, 392/653 [60%]; bottled products, 372/653 [57%]). A hydrogen peroxide-based disinfection system was the most commonly recommended care product (397/651 [61%]).

Conclusions: A reasonable degree of consensus exists regarding some aspects of scleral lens prescription and management (average lens diameter, daily wearing time, and use of nonpreserved products for lens application). Further study is needed to develop evidence-based guidelines for scleral lens prescription and management.

From the Illinois College of Optometry (J.H.), Chicago, IL; Department of Ophthalmology (C.B.N., M.M.S.), Division of Optometry, Mayo Clinic, Rochester, MN; The Ohio State University School of Optometry (J.B.), Columbus, OH; Korb & Associates (A.N.), Boston, MA; Contact Lens Service (E.S.), University of Chicago, Chicago, IL; and Biostatistics Unit (N.T.C., D.O.H.), Mayo Clinic, Jacksonville, FL.

J. Harthan: Consulting contracts: Morgan, Bausch + Lomb/Valeant, Metro Optics; J. Barr: Stock holder: Envision, Access Media, Consulting contracts: Bausch + Lomb/Valeant Pharmaceuticals and NovaBay. Contract research: Innovega and Valeant Pharmaceuticals; M. M. Schornack: Advisor: Bausch + Lomb/Valient; C. B. Nau, A. Nau, E. Shorter, D. O. Hodge. The remaining author has no conflicts of interest to disclose.

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Presented in part as posters at the American Academy of Optometry, October 7–11, 2015, New Orleans, LA, and Global Specialty Lens Symposium, January 21–24, 2016, Las Vegas, NV.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.eyeandcontactlensjournal.com).

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Visual and physiological outcomes of scleral lens wear

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[b] Korb and Associates, Boston, MA, United States
[c] Illinois College of Optometry, Chicago, IL, United States
[d] The Ohio State University, C
[e] University of Illinois at Chica

Table 4
A total of 164 adverse events were reported during 734.3 patient years of lens wear. The most common adverse finding was conjunctival injection, followed by handling/application error.

	Corneal Irregularity	Ocular Surface Disease	Refractive Error	Total
Conjunctival Findings				
				73
				15
				5
				1
				5
				14
Neovascularization	9	1	0	10
Bullae	2	0	0	2
Infiltrates	1	0	0	1
Limbal edema	8	1	0	9
Limbal hypoxia	2	0	0	2
Other Findings				
Handling/application error	19	2	2	23
Uveitis	2	0	0	2
Toxic keratopathy	1	0	0	1
Increased intraocular pressure	0	1	0	1
Total	**146**	**14**	**4**	**164**

Table 4
A total of 164 adverse events were reported during 734.3 patient years of lens wear. The most common adverse finding was conjunctival injection, followed by handling/application error.

CASE REPORT

Case Series: Corneal Epithelial Macrocysts in Scleral Contact Lenses Post–penetrating Keratoplasty

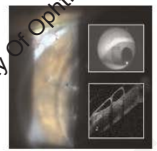
Linda Trang Nguyen, OD, FAAO,[1]* David Yang, OD, FAAO,[1] and Lee Vien, OD, FAAO[1]

SIGNIFICANCE: Transitory corneal epithelial macrocysts associated with scleral contact lens wear post–penetrating keratoplasty are observed in areas of corneal edema. The macrocysts do not appear to result in complications that would prevent successful wear of scleral contact lenses.

PURPOSE: The purpose of this study is to report three cases of transitory corneal epithelial macrocysts associated with scleral lenses in post–penetrating keratoplasty corneas.

CASE REPORTS: Three cases including anterior segment photographs and anterior segment optical coherence tomography highlight the clinical presentation of transient corneal epithelial macrocysts.

CONCLUSIONS: Corneal edema and anatomical alterations after penetrating keratoplasty along with the positive pressure underneath a scleral contact lens are hypothesized to have caused the transient epithelial macrocysts observed in these cases. Because of the transitory nature of these cysts without evidence of consequent corneal damage or cyst rupture over years of observance, we believe that it is safe for these patients to continue wearing scleral contact lenses with routine follow-up.



Optom Vis Sci 2018;95:616–620. doi:10.1097/OPX.0000000000001245

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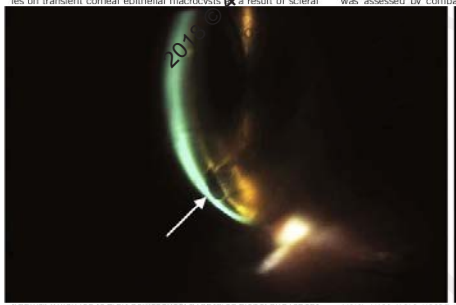
There are numerous indications for scleral contact lenses including the visual rehabilitation of irregular corneas status post–penetrating keratoplasty. Our purpose is to present three case studies on transient corneal epithelial macrocysts as a result of scleral

His best-corrected visual acuity was 20/30 in each eye with 1-month-old Tyro-97 (Lagado Corporation, Englewood, CO) mini-scleral lenses worn for 9 hours. The amount of central clearance was assessed by comparison of the fluid reservoir beneath the



post–penetrating keratoplasty with replacement of the intraocular lens of the right eye. His ocular medications included rimexolone 1% one drop in each eye nightly.

in the left cornea in all quadrants except superiorly. The central corneal grafts remained clear with no signs of rejection or infection.

Contact Lens and Anterior Eye 41 (2018) 307–310

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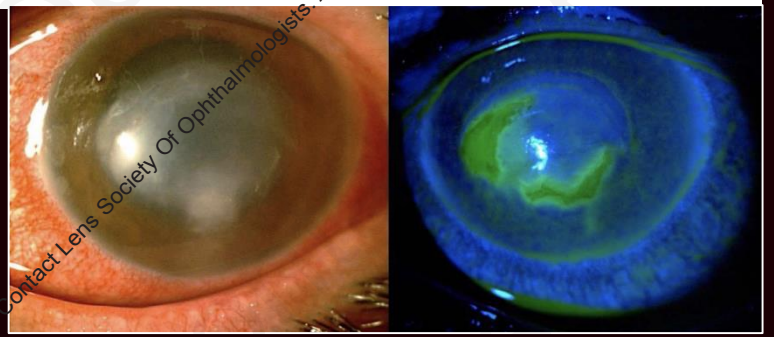
Acanthamoeba keratitis in patients wearing scleral contact lenses

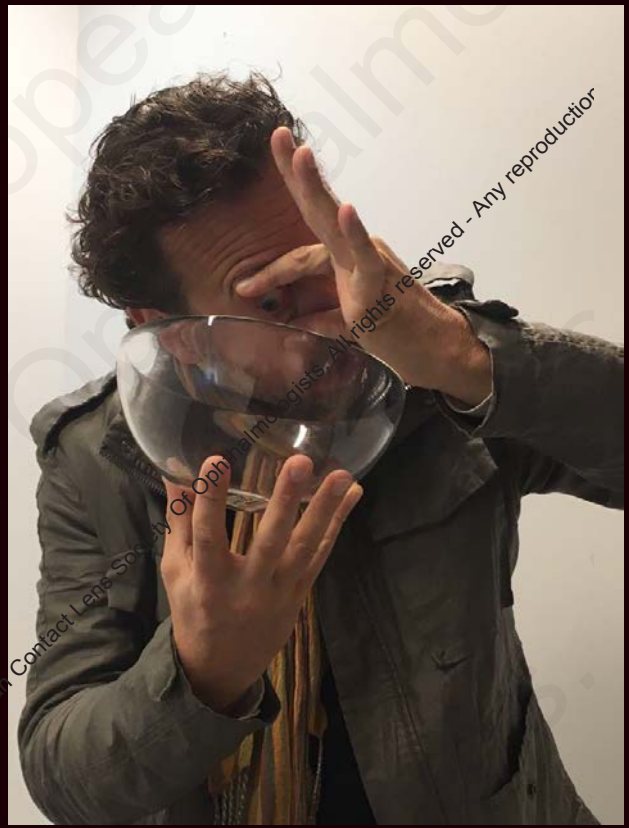
Matheus Porto Sticca, Linda C. Carrijo-Carvalho, Isa M.B. Silva, Luiz A. Vieira, Luciene B. Souza, Rubens Belfort Junior, Fábio Ramos S. Carvalho, Denise Freitas*

Department of Ophthalmology and Visual Sciences, Paulista School of Medicine, São Paulo Hospital, Federal University of São Paulo, São Paulo, Brazil, Brazil



LENS HANDLING

Safety….



Scleral Lens Controversies

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Contact Lens and Anterior Eye

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Visual quality with corneo-scleral contact lenses for keratoconus management—Part II

Juan Carlos Montalt[a], Esteban Porcar[a,*], Enrique España-Gregori[b], Cristina Peris-Martínez[c]

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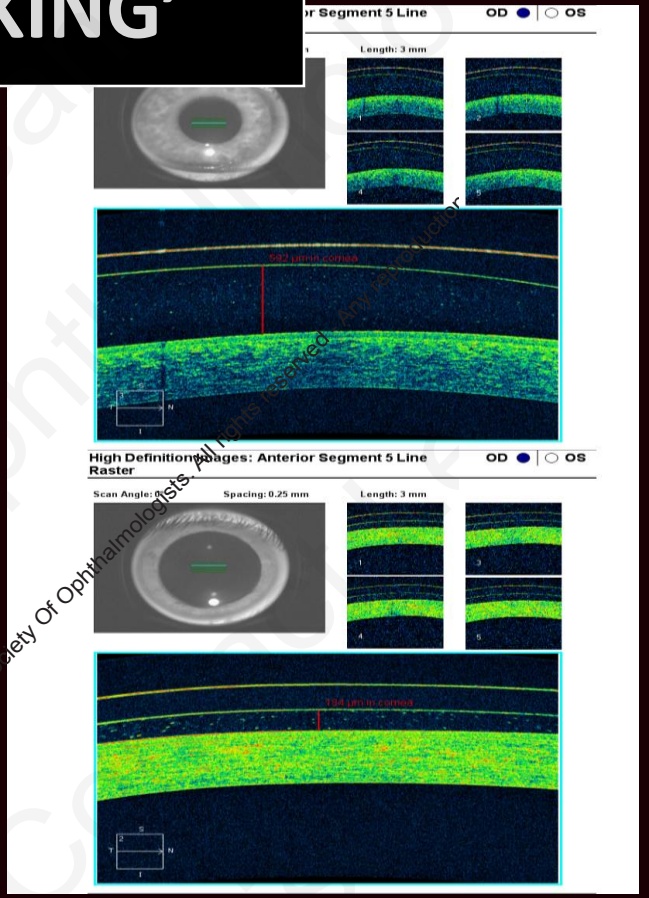
12.6 – 13.5MM

CLEARANCE

'SINKING'



Kaufmann - 109 micron (8h)

Pacific University - 127 micron (8 h)

Mountford - 146 micron (30 days)

50% settling in the 1st hour

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Posterior cornea and thickness changes after scleral lens wear in keratoconus patients

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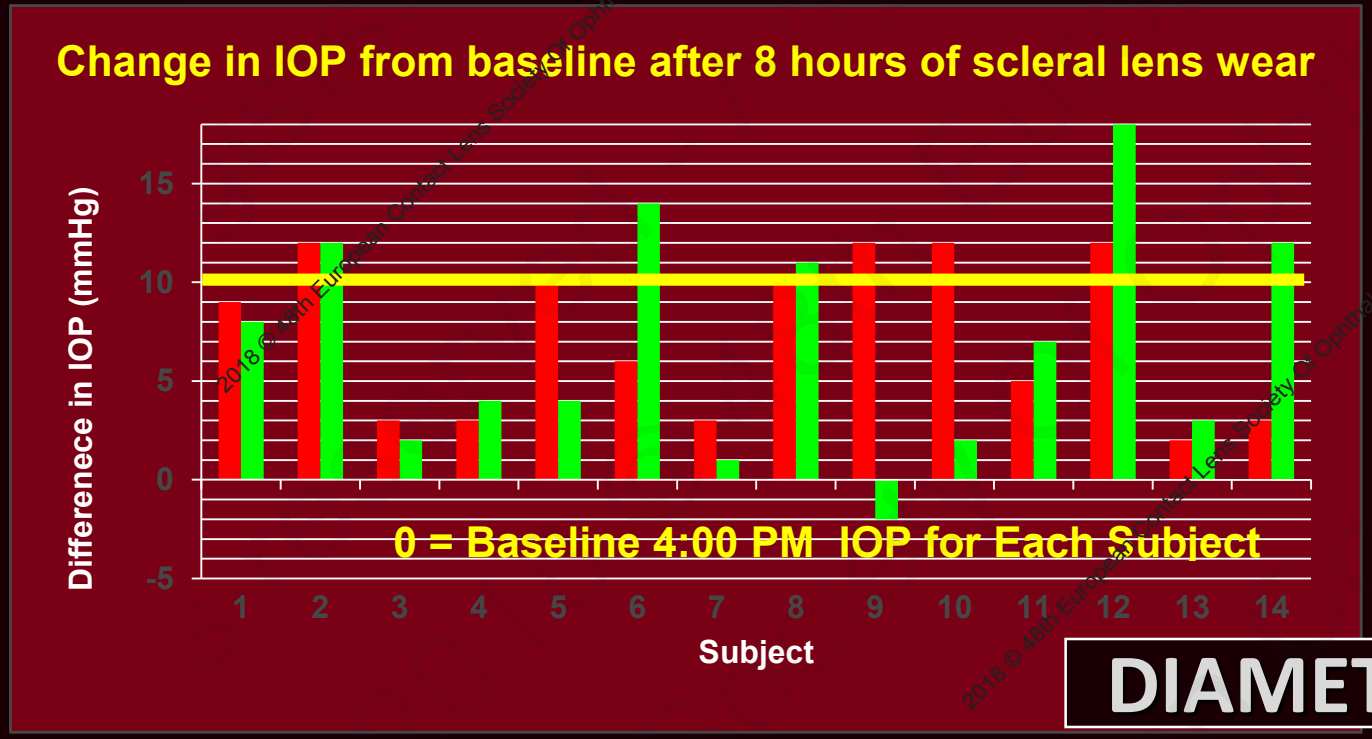
Conclusions: Short-term scleral lens wear showed a thinning of the cornea and changes in the posterior corneal curvature affects different regions in keratoconus patients with and without ICRS.

Scleral Lens Controversies

IOP INCREASE?



Pacific University Oregon

DIAMETER RELATED?

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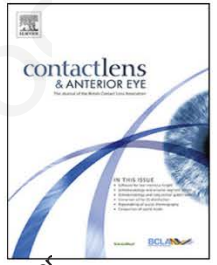

Intra-ocular pressure variation associated with the wear of scleral lenses of different diameters

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These results suggest that, as evaluated with a non-standard transpalpebral methodology, IOP during scleral lens wear may be increased in average by 5 mm Hg, regardless of the lens diameter. More work is needed to confirm if practitioners should be warned when using SL on populations at risk for glaucoma.

Effect of Scleral Lens Wear on Intraocular Pressure

Poster board Number: 1765 - B0080

Disclaimer: The authors have nothing to report.

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BACKGROUND

With renewed interest in prescribing Scleral Contact Lenses (ScCL) because of their effectiveness in the treatment of moderate to severe corneal ectasia, we wanted to determine if ScCL wear affect intra-ocular pressure (IOP), since they rest entirely on the sclera.

METHODS

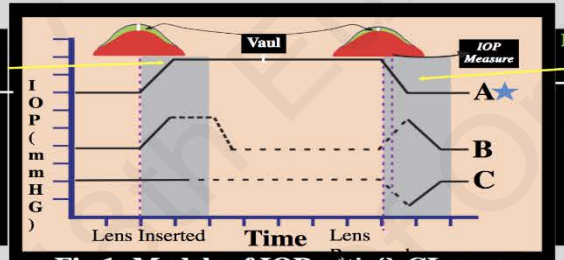
Nine subjects with normal corneas and IOP, were recruited for an Institutional Review Board approved study. Best fit ScCL from a 15.8mm diameter 0.4mm thick commercially available trial-lens set was fitted for a randomly selected eye. A soft contact lens was fitted in the fellow eye. Three IOP measurements were taken with rebound iCare tonometer prior to lens insertion (about 9:30AM), and immediately after lens removal (about 5:30PM). Initial and final central lens vault was determined with anterior segment Zeiss optical coherence tomography (OCT). Mean pre-and post-lens wear IOP was calculated for each eye and the means were analyzed with a Student-test and Bland Altman plot.

RESULTS

IOP increased with ScCL wear for all subjects (Table 1). Soft lens eyes showed a slight increase for some, but decreased in others. Unpaired t-test showed a significant difference ($p < 0.05$, $R2=0.5014$) between the mean IOP for ScCL eyes and soft lens eyes. Bland-Altman bias was 6.43 (SD of bias 3.139). ScCL settling ranged from 56 µm to 200 µm, with a mean of 104 ± 53.62 µm. There was no correlation between IOP change and amount of settling.

Negative Episcleral Pressure

From un-replenished tears during lens settling. This presumably leads to an increase in IOP



Positive Episcleral Pressure

From lens removal. Brings the eye back to atmospheric pressure, which should lead to a momentary decrease in IOP

Fig 1: Models of IOP with ScCL wear

Sub.	ScCL IOP (mm Hg)			Soft Lens IOP (mm Hg)			ScCL Central Vault (µm)		
#	*Baseline*	*Final*	*Change*	*Baseline*	*Final*	*Change*	*Baseline*	*Final*	*Settling*
1	9.67	12.33	2.67	10.33	9.00	-1.33	364	300	64
2	23.00	30.33	7.33	22.67	22.67	0.00	420	220	200
3	17.33	20.33	3.00	18.00	17.00	-1.00	604	528	76
4	26.00	40.67	14.67	26.00	28.33	2.33	436	280	156
5	18.33	21.67	3.33	18.33	13.33	-5.00	564	396	168
6	19.67	23.00	3.33	21.33	20.67	-0.67	320	264	56
7	10.00	16.33	6.33	10.33	11.67	1.33	200	120	80
8	12.67	20.33	7.67	16.67	14.67	-2.00	460	364	96
9	12.33	20.33	8.00	12.00	14.00	2.00	220	148	72

Table 1: IOP and central vault pre- and post-lens wear

DISCUSSION

This study measured IOP *after* lens removal and inferred IOP with lens on eye. Fig. 1 shows different models for IOP change with the lens on the eye. Model "A" supports our assumption. One study3 measured IOP in 2 subjects with ScCL on the eye and did not find a significant increase in IOP with ScCL wear. However, the study found that IOP was consistently higher in the ScCL eye vs no-contact lens eye.

CONCLUSIONS

ScCL eyes showed increased IOP upon lens removal, suggesting increased IOP with lens on eye. Eye care practitioners must consider this possible outcome in treating patients with ScCL and prudent measures should be in place to monitor IOP.

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Scleral Lens Controversies

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Differences in corneo-scleral topographic profile between healthy and keratoconus corneas

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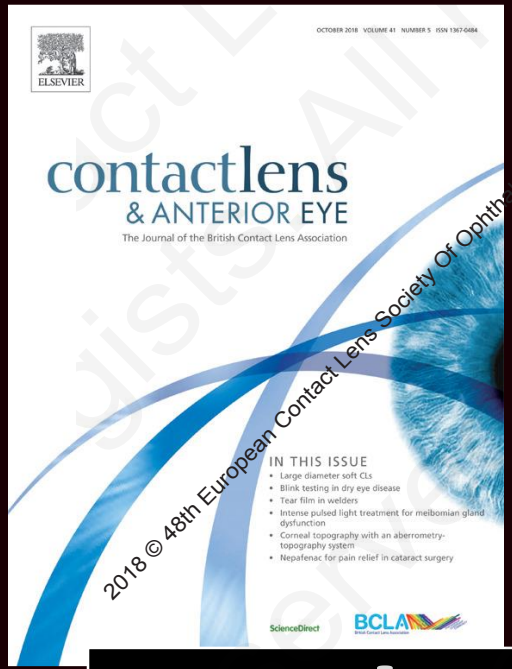
The corneo-scleral profile in keratoconus presents higher levels of asymmetry compared to healthy eyes, especially in eyes with moderate and advanced stages of the disease. The diagnostic accuracy of corneo-scleral topographic data alone for keratoconus detection is limited and must be used in conjunction with other clinical parameters.



Scleral Lens Controversies

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