

18th International Conference of the
Research Institute of Ophthalmology

RIO 2026

22 -23 JANUARY 2026
ROYAL MAXIM PALACE KEMPINSKI, CAIRO



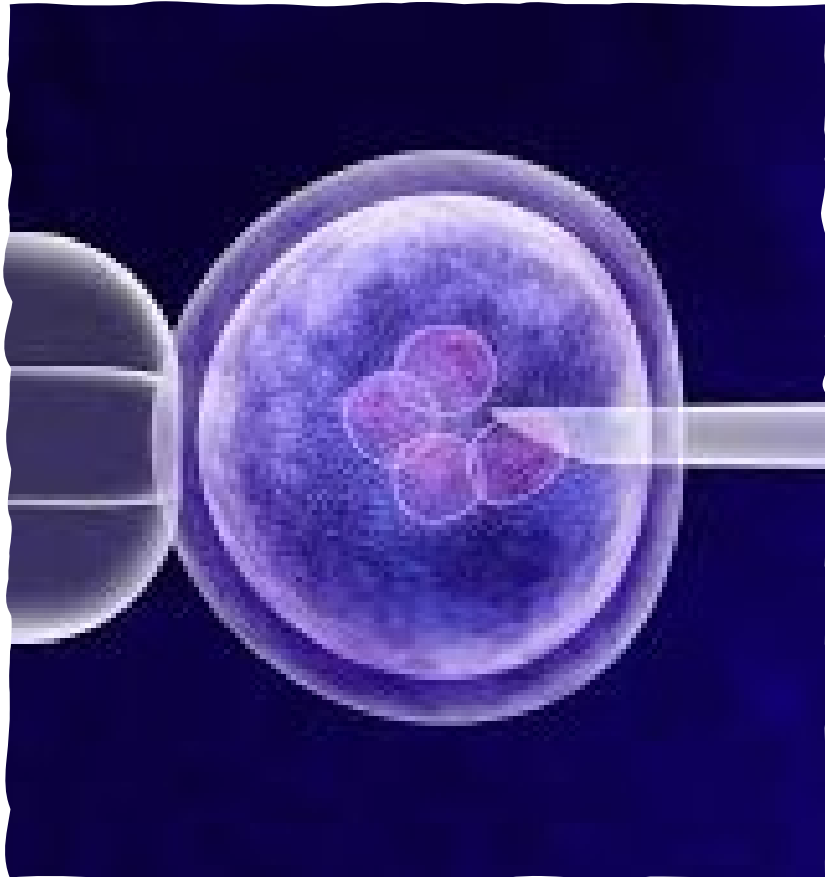
Who's the Culprit?
A case presentation of
pediatric keratoconus

Dr. Lina Hoshan

A routine
referral ..



Case History



4 year old female patient presented to our clinic for Reduced vision

She was born at full term via cessarian section

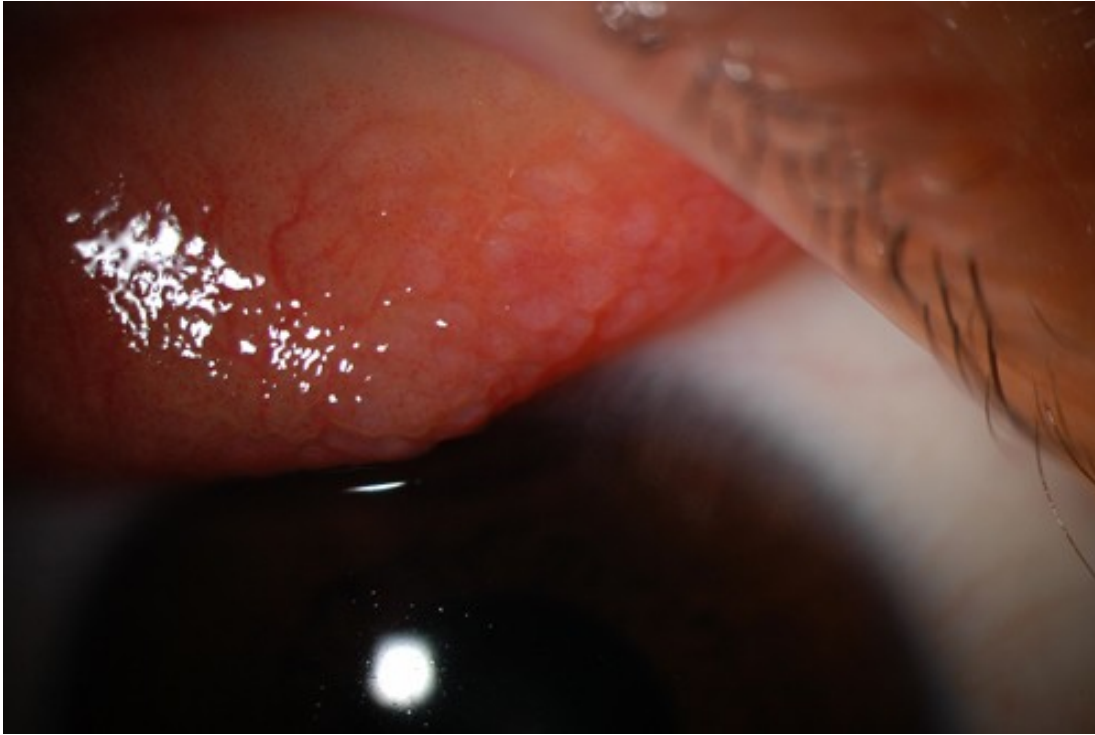
Conceived through Assisted Reproductive Technology (IVF)

Dizygotic twin

NICU addmission

Parental consanguinity

No FHx of ocular or systemic disease



	Sph	Cyl	Axis	BCVA
OD	-8.00	-6.00	10	6/12 (0.50)
OS	-8.00	-5.00	5	6/12 (0.50)

Ophthalmic Exam

- **UDVA : 6/60 (0.1)**
- **Allergic papillary conjunctivitis**
- **Anterior segment: normal**
- **Posterior segment: normal**



	Sph	Cyl	Axis	BCVA
OD	-8.0 0	-6.0 0	10	6/12 (0.50)
OS	-8.0 0	-5.0 0	5	6/12 (0.50)

• Refractive Error



Investigation

OCULUS - PENTACAM 4 Maps Selectable

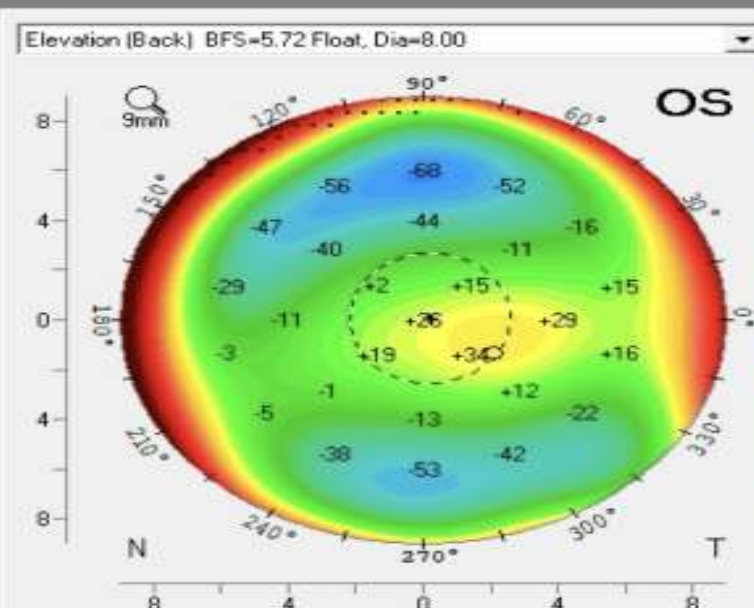
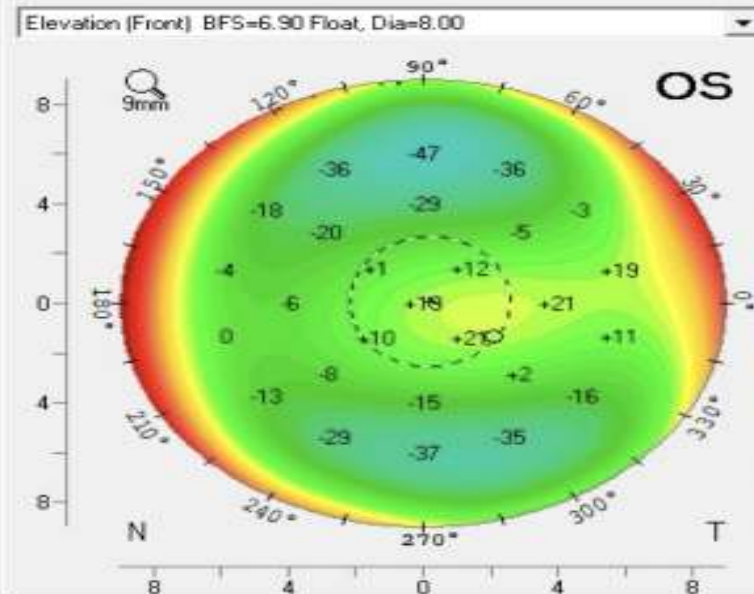
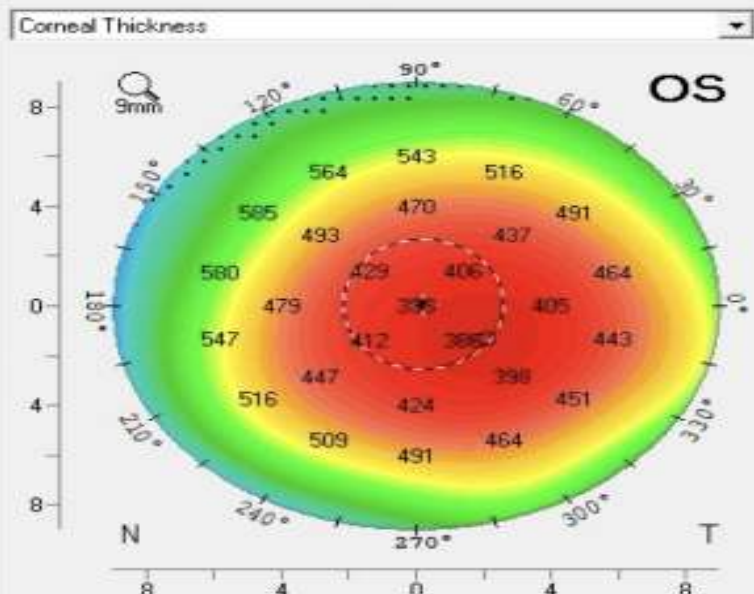
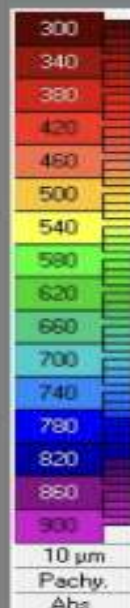
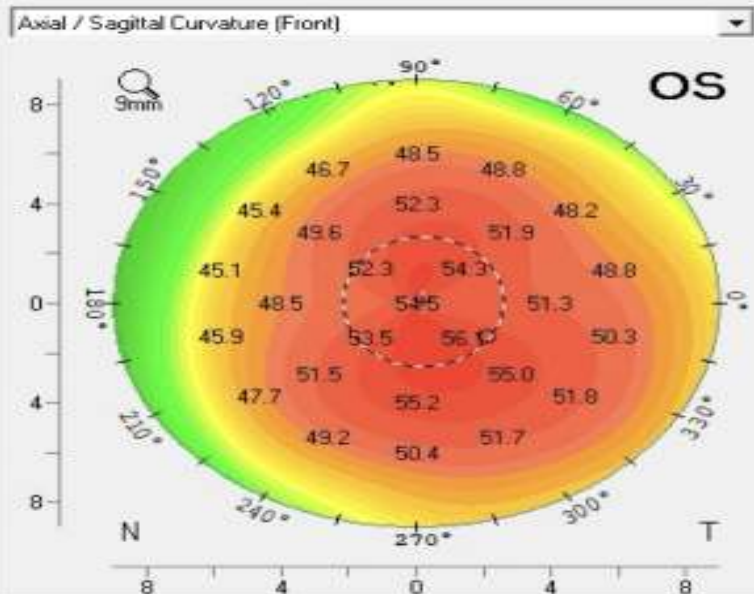
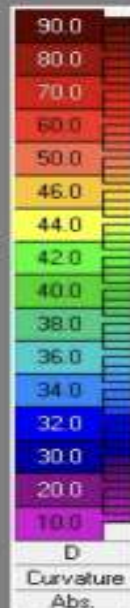
1.34/01

Last Name: Mohamed
First Name: Sagda
ID:
Date of Birth: 02/02/2020 Eye: Left
Exam Date: 08/18/2025 Time: 10:13:32
Exam Info:



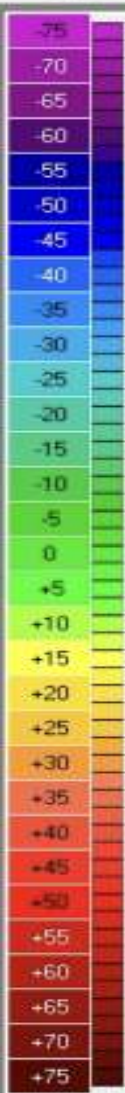
Pupil Center: + 398 μ m x[mm] +0.10 y[mm] +0.03
Pachy Vertex N.: 399 μ m 0.00 0.00
Thinnest Locat.: O 385 μ m +1.06 -0.66
K Max. (Front): 58.1 D +0.13 -0.73

Cornea Volume: 53.1 mm³ HW/TW: 11.1 mm
Chamber Volume: 196 mm³ Angle: 37.9°
A. C. Depth (Int.): 3.43 mm Pupil (3D): 2.49 mm
Enter IOP IOP(Sum): +6.0 mmHg Lens Th:

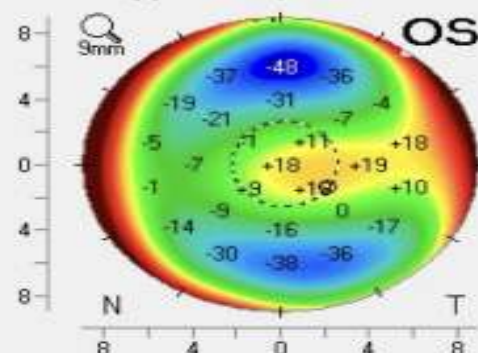


OCULUS - PENTACAM Belin/Ambrósio Enhanced Ectasia Display

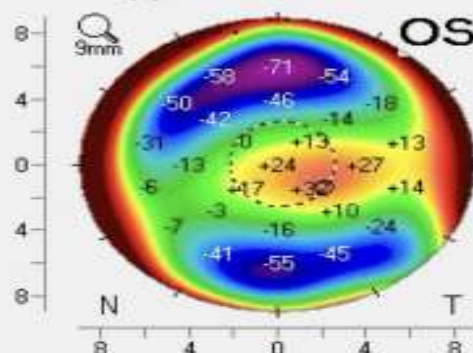
1.34r01


Elevation (Front)

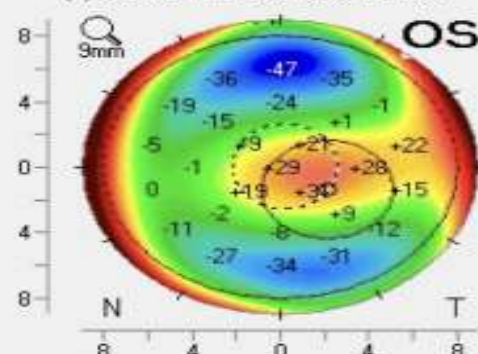
(F)r=6.89 Float, Dia=8.00


Elevation (Back)

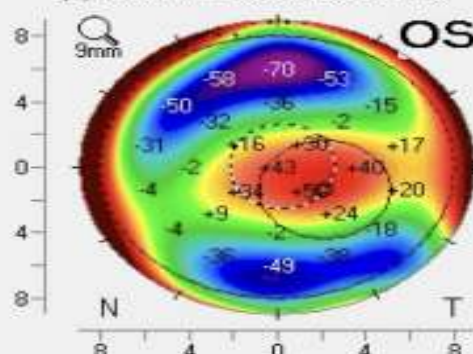
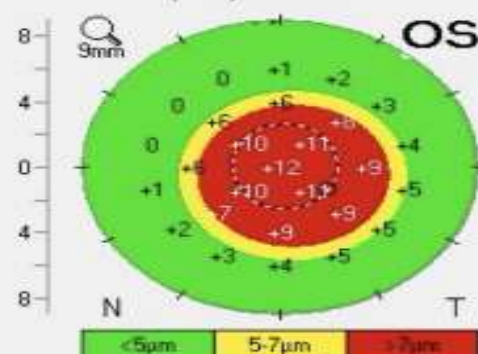
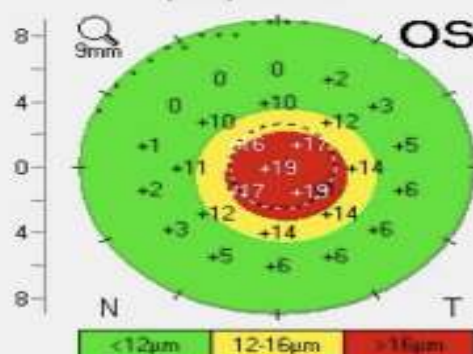
(B)r=5.73 Float, Dia=8.00



(F) Excl.3.0mm r=6.97 Float, Dia=8.00

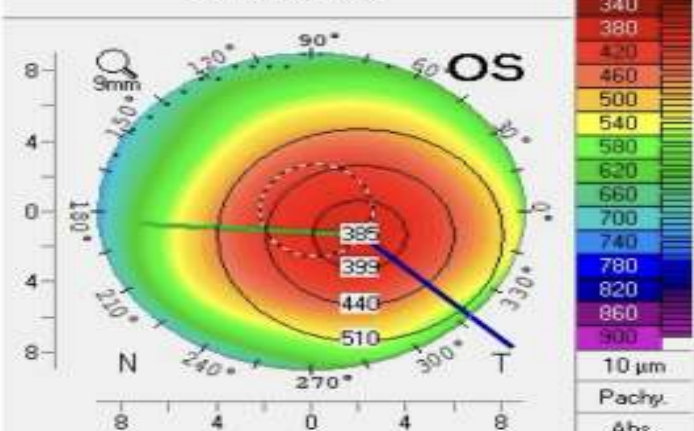
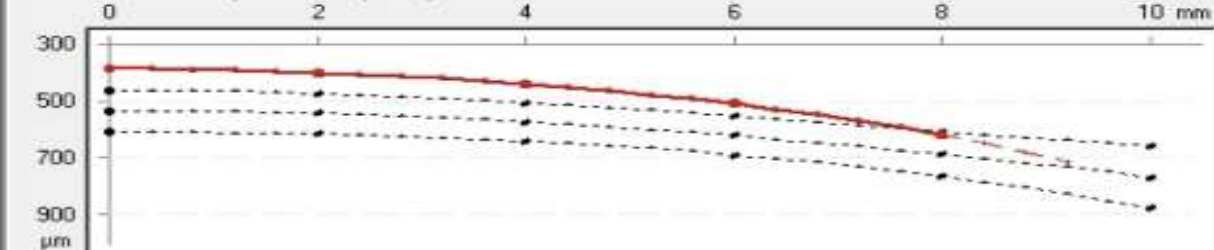
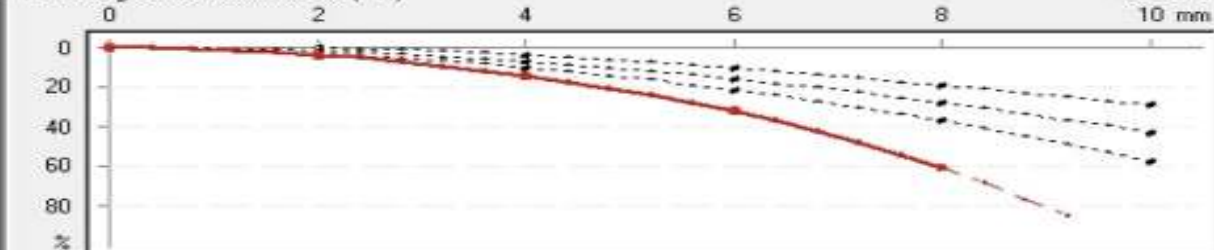


(B) Excl.3.0mm r=5.82 Float, Dia=8.00


(Front) Difference

(Back) Difference


Last Name: Mohamed
First Name: Sagda
ID:
Date of Birth: 02/02/2020 Eye: Left
Exam Date: 08/18/2025 Time: 10:13:32
Exam Info:

K1: 50.7D Axis: 2.1°
K2: 55.4D Q-val: -1.20
KMax: 58.1D QS: OK
Pachy Thin. Loc.: 385µm
Dist. Vertex N.-Thin. Loc.: IT 1.25mm
F.Ele.Th: 20µm B.Ele.Th: 34µm
Progression Index:
Min: 1.35 Max: 3.05
Avg: 2.04 ARTmax: 126

Corneal Thickness

Mean corneal thickness values on rings concentrically to the thinnest location
Corneal Thickness Spatial Profile (CTSP)

Percentage Thickness Increase (PTI)


Reference Database: ☒ Myopic/Normal ☐ Hyperopic/Mixed Cyl Literature
Df: 6.12 Db: 3.37 Dp: 7.65 Dt: 6.14 Da: 3.31 D: 7.50

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

1.7/2990

Patient Examination Display Export Settings External software

E-Mail AVI JPG

Name: Mohamed, Sagda

ID:

Date of birth: 02.02.2020

Age: 5

Exam. Date: 25.08.2025

Time: 11:59:17

Eye: Left (OS)

Exam. Date: 18.08.2025

Time: 10:13:32

Eye: Left (OS)

Info:

QS: Alignment

Info:

QS: OK

Corvis ST - Biomechanical Assessment

Distributions: ■ NORMAL Population ■ KERATOCONUS Population

Stiffness Parameter A1

31.7

Integrated Radius

13.4

ARTh

DA Ratio

5.3

A1

HC

A2

2.31 ms IOPnct: 7.0 mmHg bIOP: 9.6 mmHg

CBI

0.25

0.50

0.75

1.00

1.00

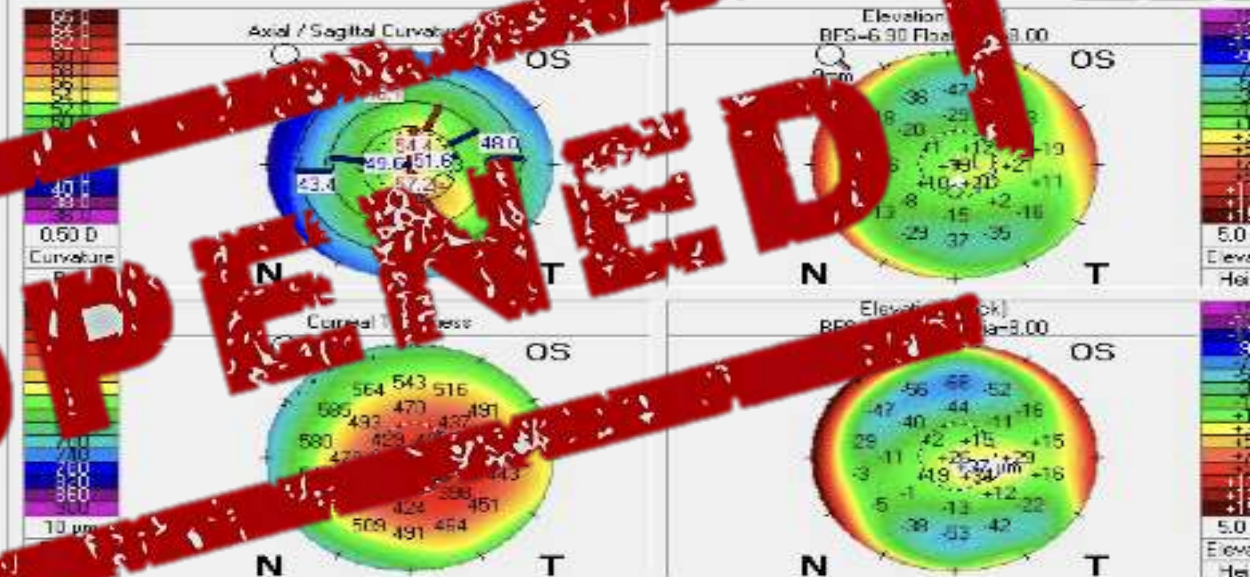
Reference Ethnicity Global database Treatment untr

TBI

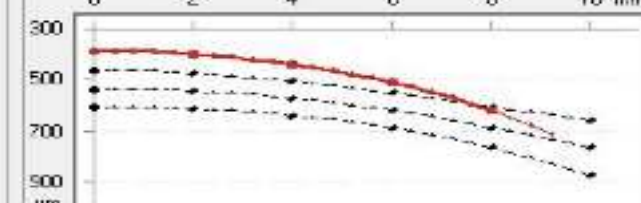
35582 Wetzlar

1.00

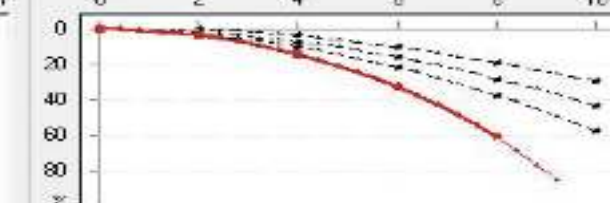
Pentacam - Tomographic Assessment



Corneal Thickness Spatial Profile (CTSP) Diameter 10 mm



Percentage Thickness Increase (PTI) Diameter 10 mm



K Max: 58.1 D IS Value: 2.6 D PRFI: 0.99 TKC:

BAD D

myopic hyperopic

1.6

3

7.50



Case 2 (twin) - History

Full-term delivery via C/S

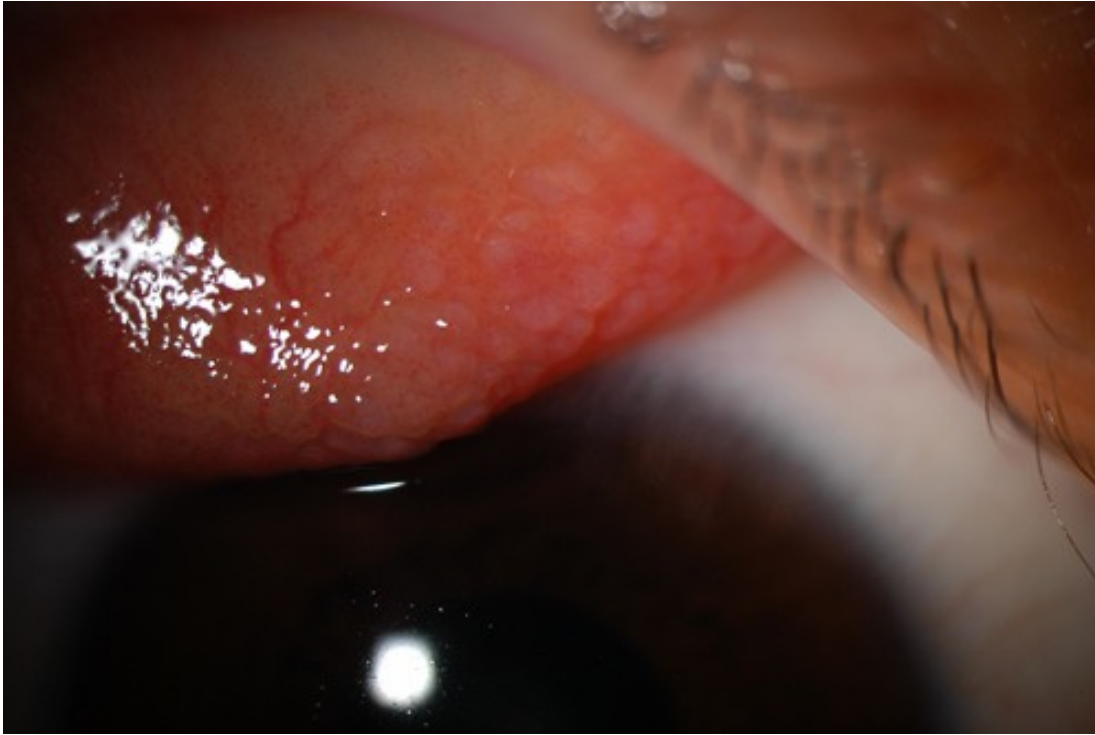
Conceived via ART / IVF

No NICU

No systemic or ocular history

No FHx of systemic or ocular disease





	Sph	Cyl	Axis	BCVA
OD	-0.75	-2.00	165	6/9
OS	-0.50	-1.75	20	6/9

Opthalmic Exam

- **V/A: UDVA 6/18 OD. 6/12 OS**
- **Allergic papillary conjunctivitis**
- **Anterior segment : normal**
- **Posterior segment: normal**

OCULUS - PENTACAM 4 Maps Selectable

1.34r01

Last Name: Mohamed
 First Name: Sedra
 ID:
 Date of Birth: 10/26/2020 Eye: Left
 Exam Date: 08/25/2025 Time: 10:17:10
 Exam Info:

Cornea Front

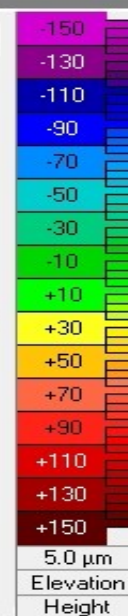
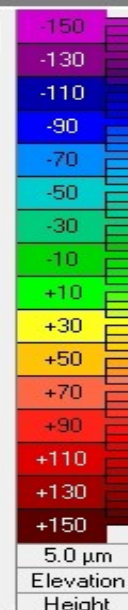
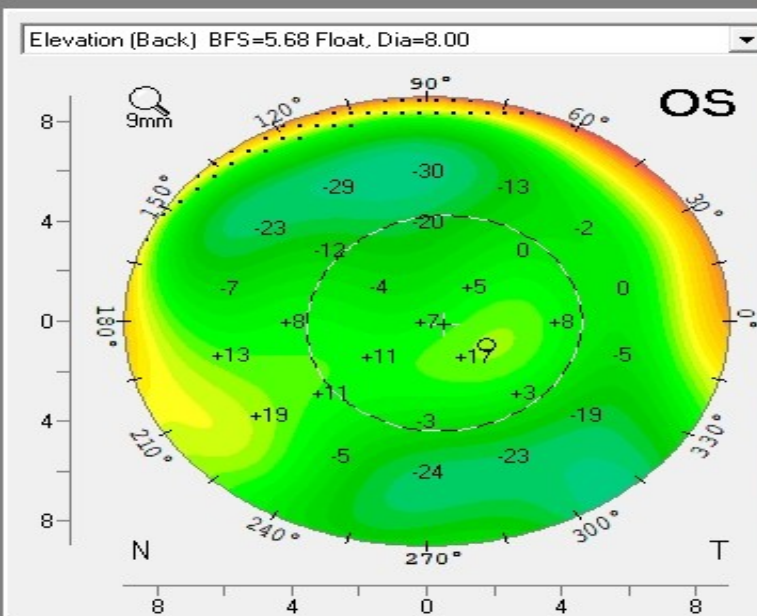
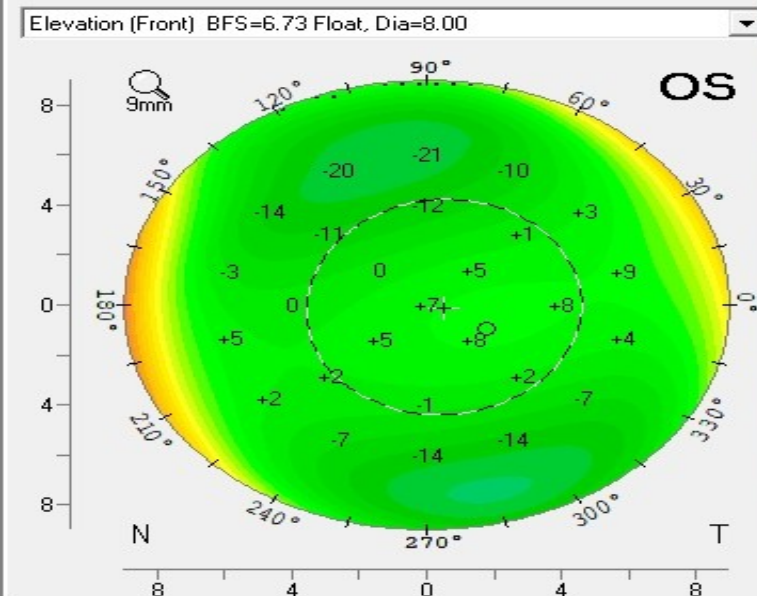
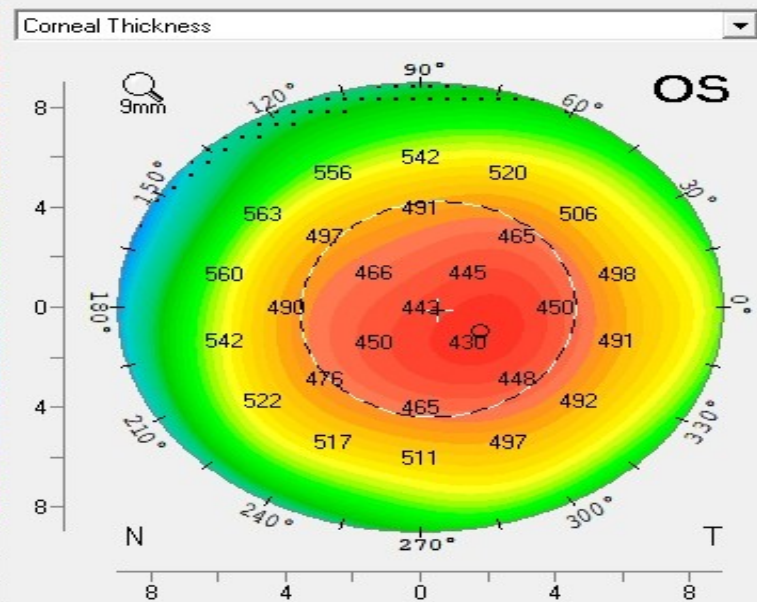
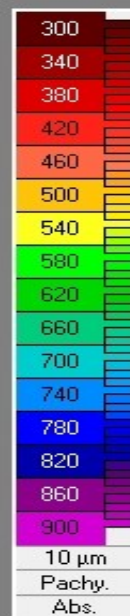
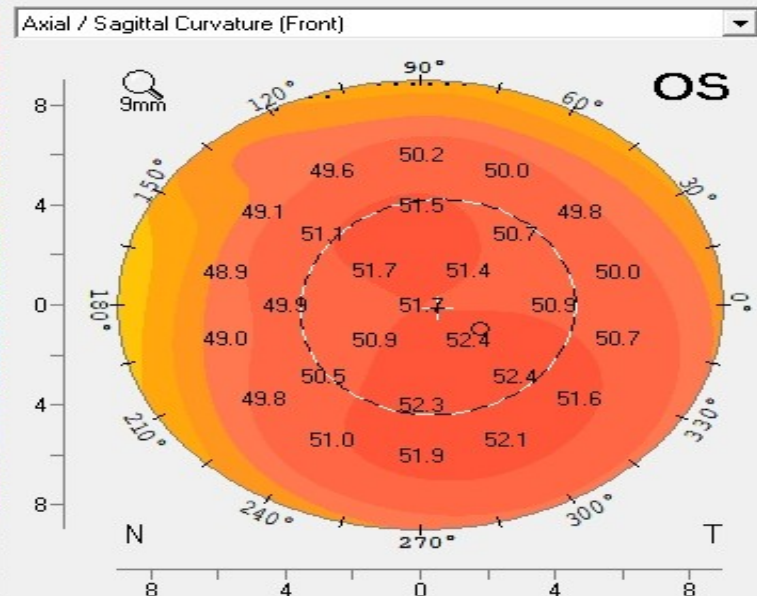
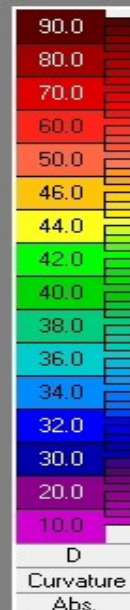
Rf: 6.69 mm K1: 50.4 D
 Rs: 6.45 mm K2: 52.4 D
 Rm: 6.57 mm Km: 51.4 D
 Qs: Pupil (Ir) Axis: (flat) 14.4 ° Astig: 1.9 D
 Q-val.: (8mm) -0.40 Rper: 6.96 mm Rmin: 6.40 mm

Cornea Back

Rf: 5.73 mm K1: -7.0 D
 Rs: 5.42 mm K2: -7.4 D
 Rm: 5.57 mm Km: -7.2 D
 Qs: Pupil (Ir) Axis: (flat) 10.6 ° Astig: 0.4 D
 Q-val.: (8mm) -0.25 Rper: 5.82 mm Rmin: 5.08 mm

Pachy: x[mm] y[mm]
 Pupil Center: + 438 µm +0.26 -0.05
 Pachy Vertex N.: 443 µm 0.00 0.00
 Thinnest Locat.: 429 µm +0.89 -0.48
 K Max. (Front): 52.8 D +0.07 -0.34

Cornea Volume: 55.7 mm³ HWTW: 11.5 mm
 Chamber Volume: 212 mm³ Angle: 52.1 °
 A. C. Depth (Int.): 3.77 mm Pupil (3D): 4.19 mm
 Enter IOP IOP(Sum): +4.3 mmHg Lens Th.:





Name: Mohamed, Sedra

ID:

Date of birth:

Age: 4

Exam. Date: 25.08.2025

Time: 10:20:57

Eye: Left (OS)

Exam. Date: 25.08.2025

Time: 10:17:10

Eye: Left (OS)

Info:

QS: Lost Points

Info:

QS: Pupil (Iris Image)

Corvis ST - Biomechanical Assessment

Distributions: NORMAL Population KERATOCONUS Population

Stiffness Parameter A1 35.8

Integrated Radius 11.5

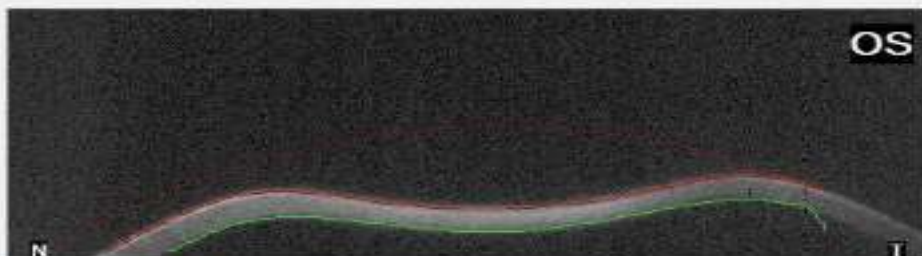
ARTh 343.8

DA Ratio 6.4

A1

HC

A2



19.64 ms

IOPnct:

9.0 mmHg

bIOP:

11.3 mmHg

CBI

0.25

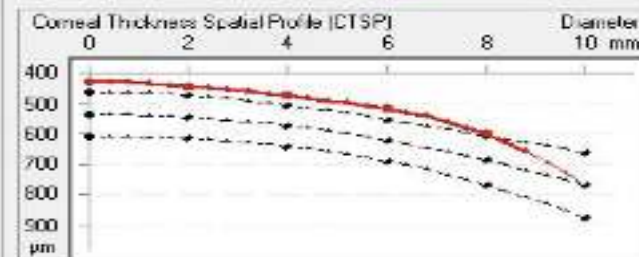
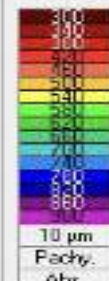
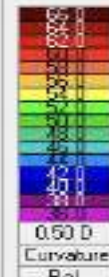
0.50

0.75

1.00

0.99

Pentacam - Tomographic Assessment



K Max:

52.8 D

IS Value:

1.4 D

PRFI:

0.89

TKC:

pos

BAD D

myopic hyperopic

1.6

4.36

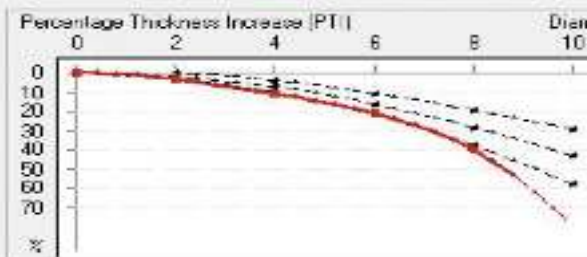
Elevation (Front)

BFS=6.73 Flat, Dia=8.00



Elevation (Back)

BFS=5.88 Flat, Dia=8.00



PRFI:

0.89

TKC:

pos

Reference Ethnicity Global database Treatment untr

TBI

0.96

35582 Wetzlar

Tel: (0641) 20 05-0

Fax: (0641) 20 05-255

www.oculus.de



Family Screening: Father

- **No ocular complaints**
- **BCVA: 6/6 ou with spectacles**
- **Normal anterior and posterior segment examination**
- **Advanced imaging performed: scheimpflug tomography, corneal biomechanics assessment**



OCULUS - PENTACAM 4 Maps Refractive

1.34r

Last Name:

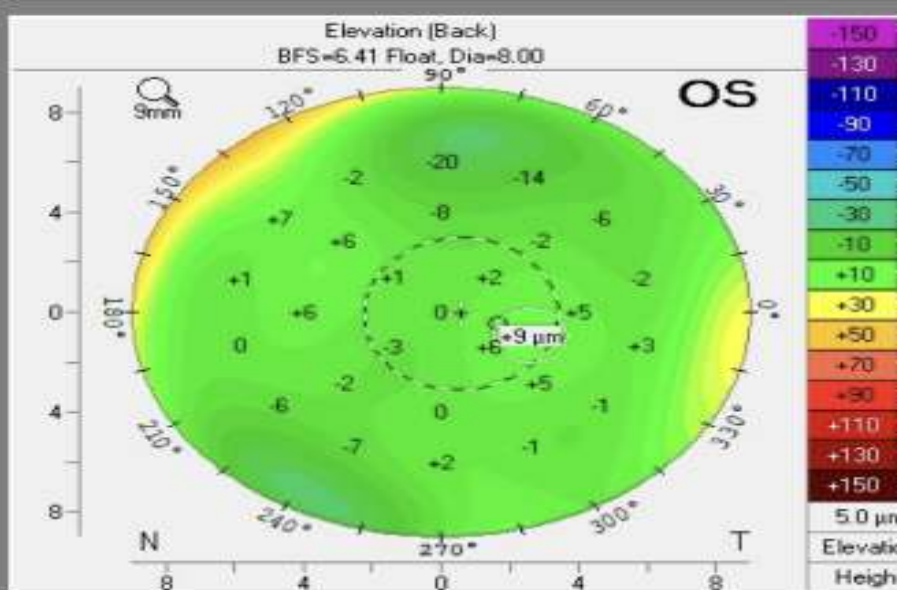
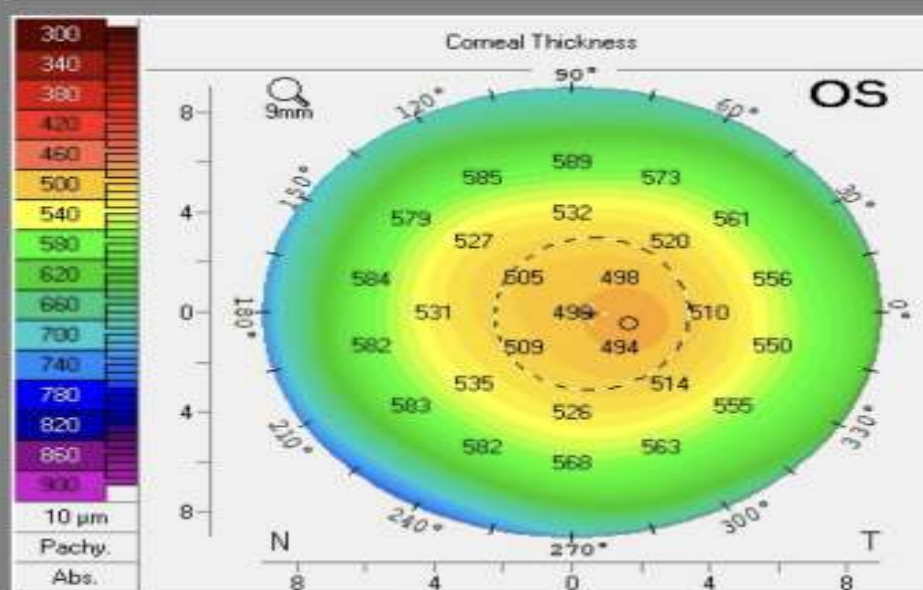
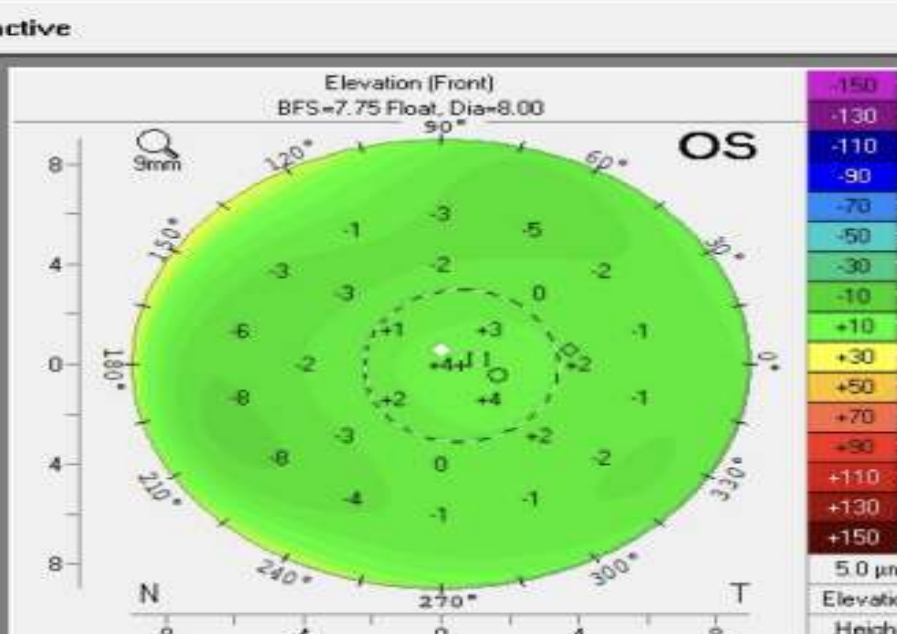
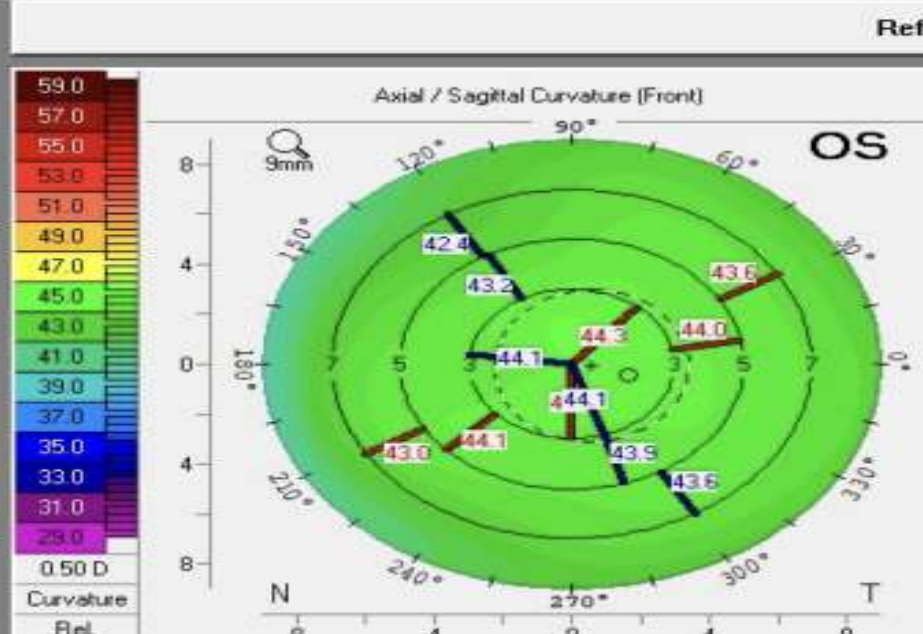
First Name:

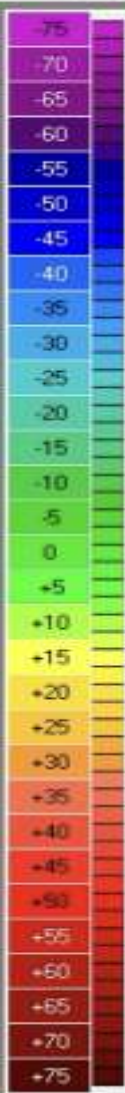
ID:

Date of Birth: Eye: Left

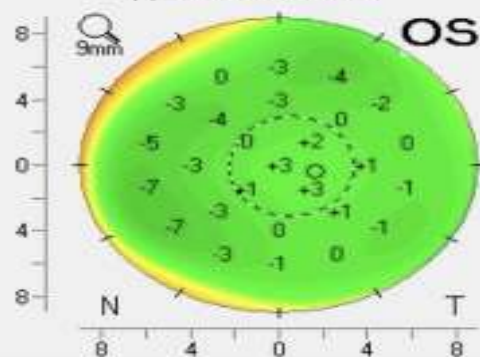
Exam Date: 08/25/2025 Time: 10:53:26

Exam Info:

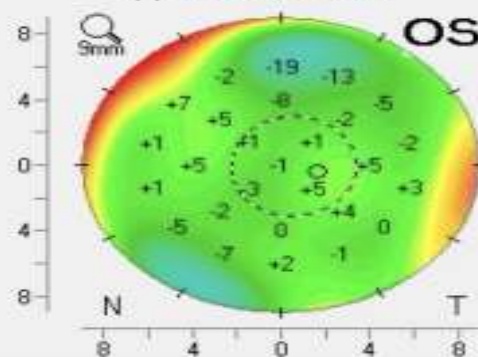



Elevation (Front)

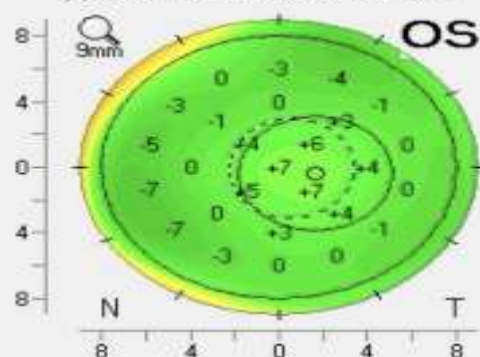
(F)r=7.73 Float, Dia=8.00


Elevation (Back)

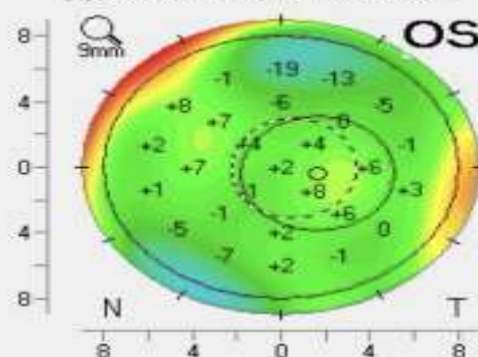
(B)r=6.40 Float, Dia=8.00



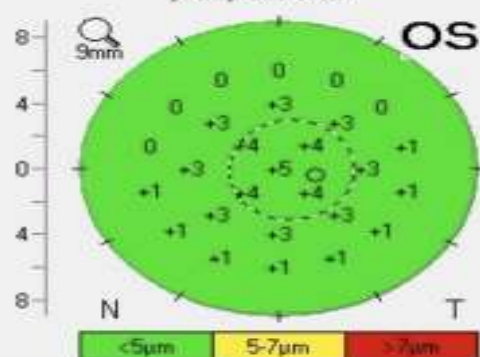
(F) Excl 3.5mm r=7.78 Float, Dia=8.00



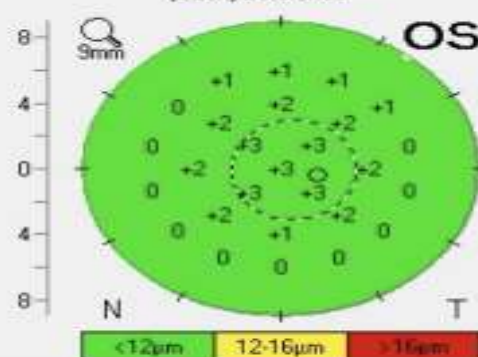
(B) Excl 3.5mm r=6.42 Float, Dia=8.00



(Front) Difference



(Back) Difference



Last Name: _____
 First Name: _____
 ID: _____
 Date of Birth: _____
 Exam Date: _____
 Exam Info: _____

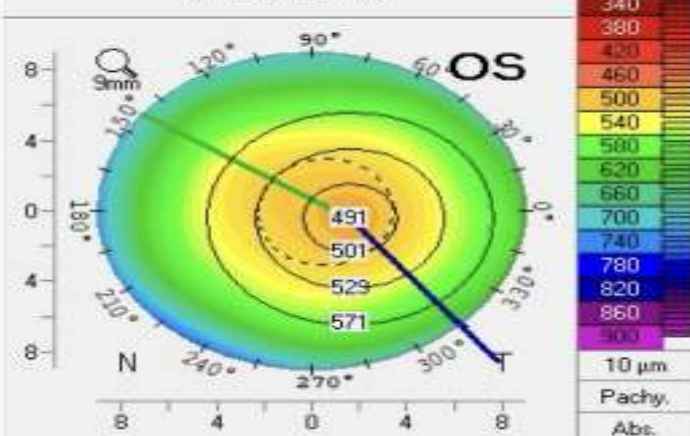
K1: 44.2D Axis: 174.1°
 K2: 44.3D Q-val: -0.36
 KMax: 44.9D QS: OK

Pachy Thin. Locat.: 491µm
 Dist. Vertex N.-Thin.Loc.: IT 0.85mm

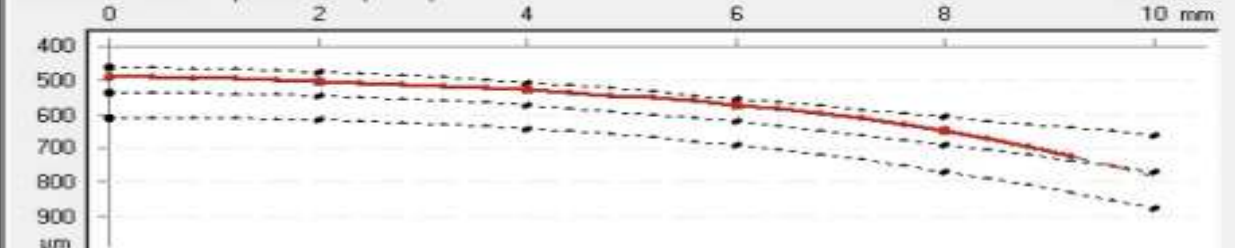
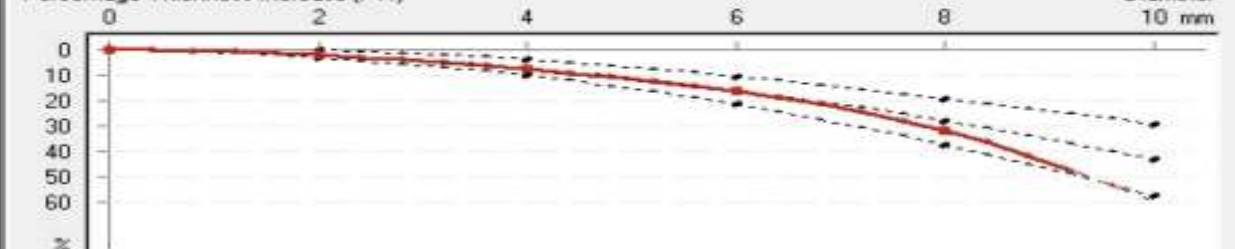
F.Ele.Th: 3µm B.Ele.Th: 6µm

Progression Index:

Min: 0.67 Max: 1.42
 Avg: 1.09 ARTmax: 347

Corneal Thickness


Mean corneal thickness values on rings concentrically to the thinnest location

Corneal Thickness Spatial Profile (CTSP)

Percentage Thickness Increase (PTI)


Reference Database: ☒ Myopic/Normal

☐ Hyperopic/Mixed Cyl.

☐ Literature

Df: 1.43 Db: -0.76 Dp: 1.27 Dt: 1.48 Da: 1.29 D: 1.59

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

1.7:2890

Patient Examination Display Export Settings External software

E-Mail AVI JPG

Name:

Exam. Date: 25.08.2025

Time: 14:40:39

Eye: Left (OS)

Info:

QS: OK

Corvis ST - Biomechanical Assessment

Distributions: ■ NORMAL Population ■ KERATOCONUS Population

Stiffness Parameter A1 74.9

Integrated Radius 8.6

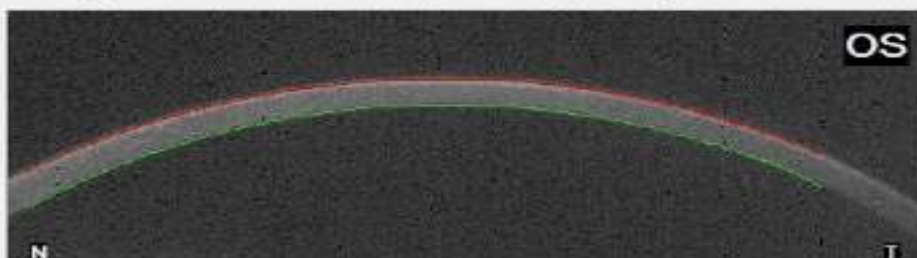
ARTh 442.8

DA Ratio 5.2

A1

HC

A2



28.41 ms

IOP_{fact}: 10.5 mmHg

bIOP: 11.6 mmHg

CBI ■ ■ ■ 0.88

Reference Ethnicity Global database Treatment untr

TBI ■ ■ ■ 0.48

Oculus Optikgeräte GmbH
Münchholzhauser Str. 29

35582 Wetzlar

Exam. Date: 25.08.2025

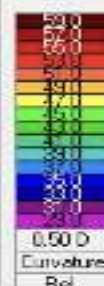
Time: 10:53:26

Eye: Left (OS)

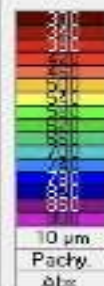
Info:

QS: OK

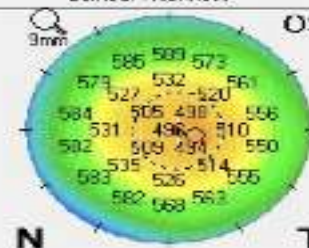
Pentacam - Tomographic Assessment



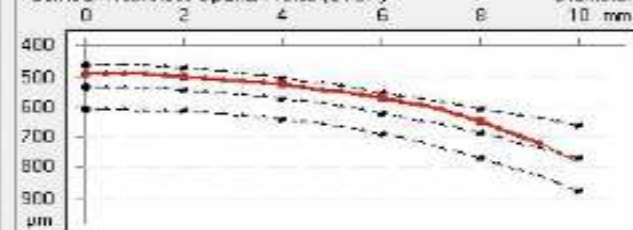
Axial / Sagittal Curvature (Front)



Corneal Thickness



Corneal Thickness Spatial Profile (CTSP) Diameter 10.0 mm



K Max.: 44.9 D

IS Value: 0.4 D

PRFI: 0.07

TKC:

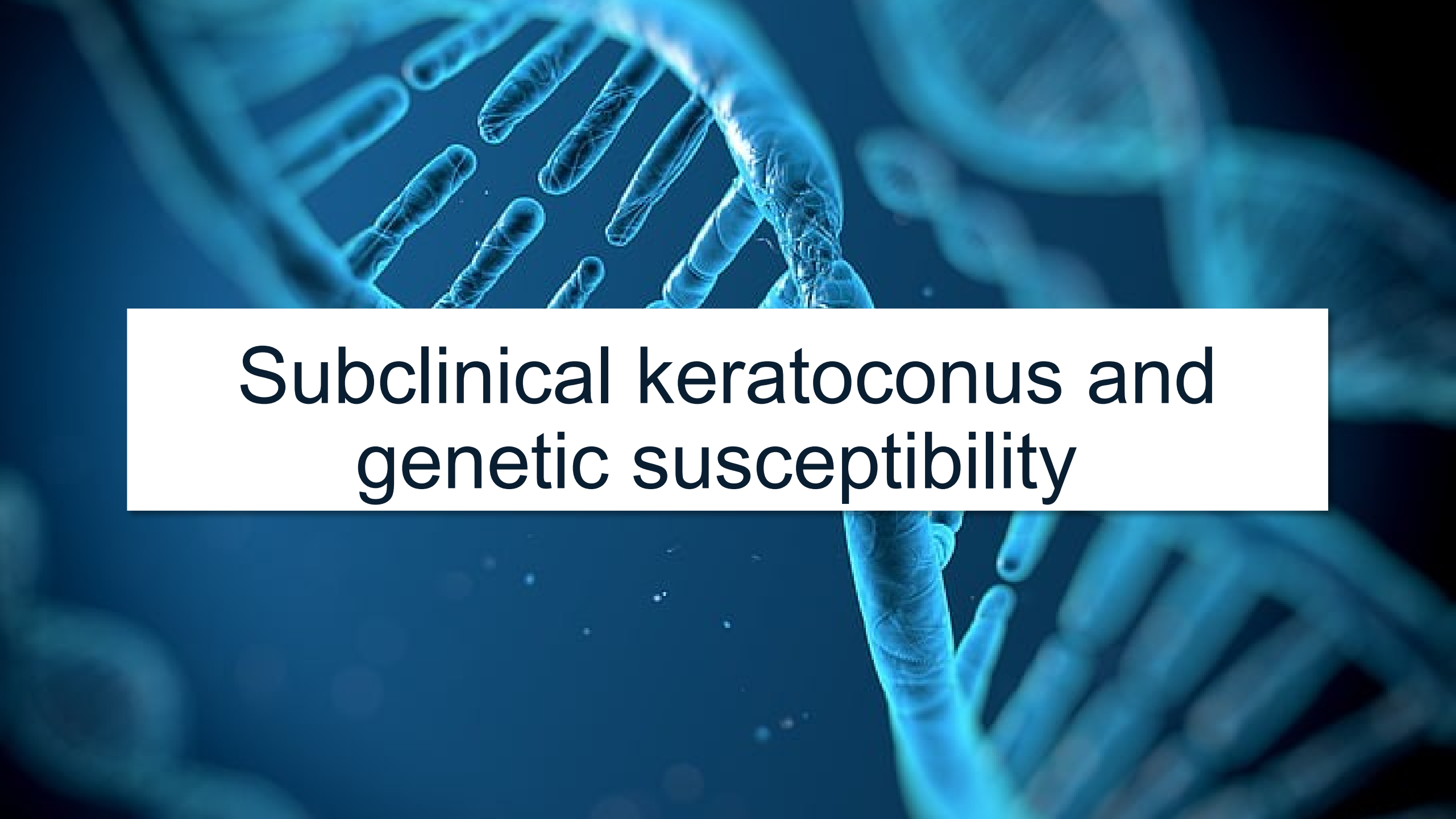
BAD D ● myopic ● hyperopic

■ ■ ■ 1.59

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Subclinical keratoconus and genetic susceptibility

Management

- **Aim: halt disease progression**
- **Epi-off Corneal CXL : sub-400 under GA**
- Alongside strict control of eye rubbing and management of allergy

> Am J Ophthalmol. 2021 Apr;224:133-142. doi: 10.1016/j.ajo.2020.12.011. Epub 2021 Jan 30.

Individualized Corneal Cross-linking With Riboflavin and UV-A in Ultrathin Corneas: The Sub400 Protocol

Farhad Hafezi ¹, Sabine Kling ², Francesca Gilardoni ³, Nikki Hafezi ⁴, Mark Hillen ⁴, Reyhaneh Abrishamchi ³, Jose Alvaro P Gomes ⁵, Cosimo Mazzotta ⁶, J Bradley Randleman ⁷, Emilio A Torres-Netto ⁸

Affiliations + expand

PMID: 33340508 DOI: 10.1016/j.ajo.2020.12.011

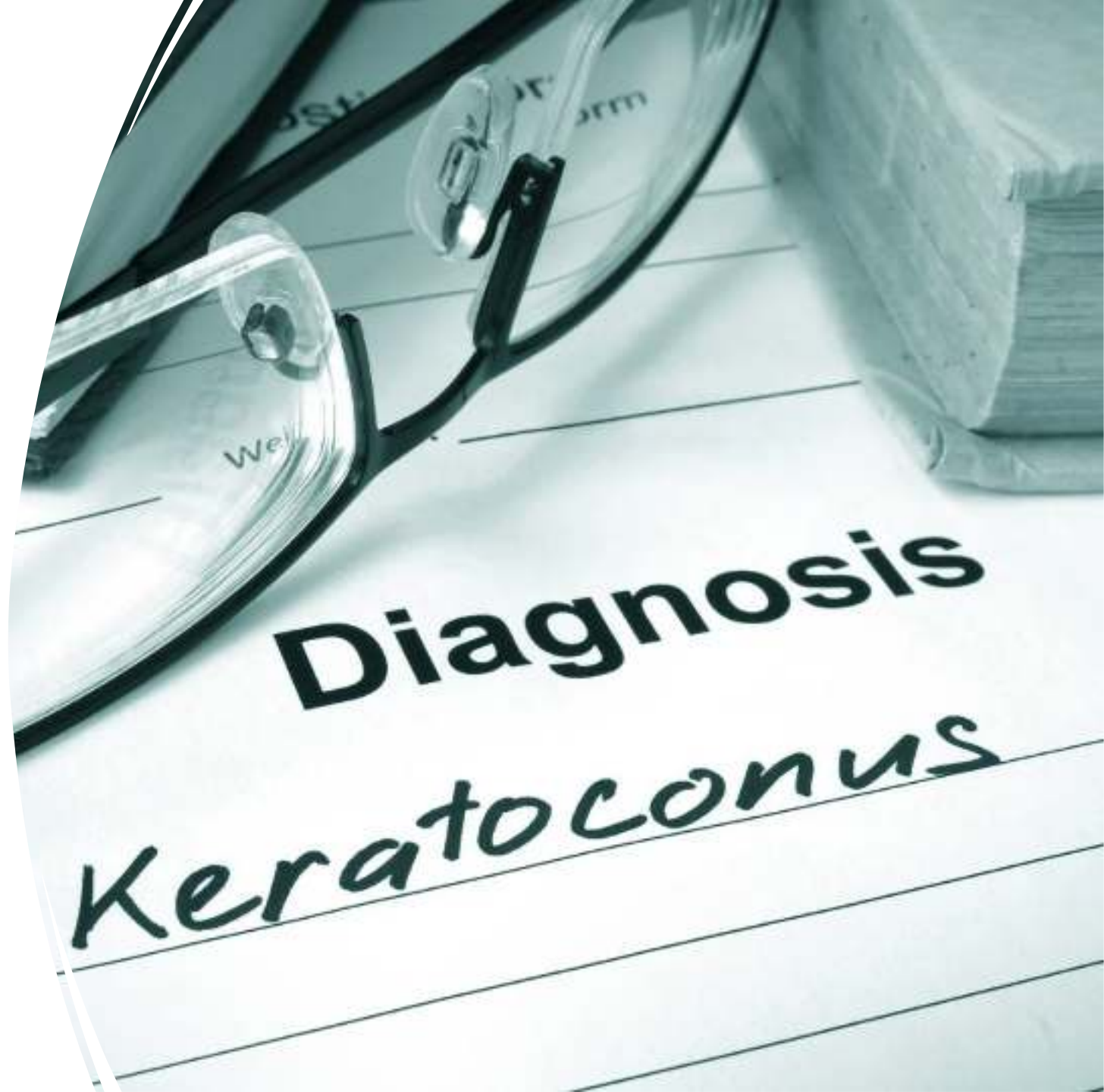
Riboflavin-UVA-induced corneal collagen cross-linking in pediatric patients

Aldo Caporossi ¹, Cosimo Mazzotta, Stefano Baiocchi, Tomaso Caporossi, Rosario Denaro, Angelo Balestrazzi

Conclusions: The study demonstrated significant and rapid functional improvement in pediatric patients younger than 18 years with progressive keratoconus, undergoing riboflavin-UVA-induced cross-linking. In pediatric age, a good functional response and keratoconus stability was obtained after corneal cross-linking in a 36-month follow-up.

Why did
keratoconus
present so
early in this
family ?

From diagnosis to etiology.



Understanding Keratoconus

- **Multifactorial : Genetic, Inflammatory, Mechanical, Microbiome, hormonal**

HORMONES AFFECTING THE CORNEA

THYROXINE

↓ HYPOTHYROIDISM

Hashimoto's thyroiditis, thyroidectomy – exacerbation / initiation the keratoconus⁴

↑ GRAVES' DISEASE

thyroxin supplementation may improve corneal biomechanics – positive correlation between CH, CRF, no CCT changes⁵

CORTISOL

↑ PROGRESSION OF KC

upregulates the enzymes level, activation MMPs⁷ altered corneal biomechanics⁸

ESTROGEN

↑ WEAKENS CORNEA

stimulation of MMPs, release the PG – activation of proteolytic enzymes for collagen, disruption of collagen networks, reduction in corneal stiffness^{6,9,10,11}

PROGESTERON

↑ PROTECTIVE EFFECT against KERATOCONUS PROGRESSION

inhibits prostaglandins that stimulate collagenases^{6,9}

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6. Y. Bykhovskaya, et al. Genetics in Keratoconus: where are we? Eye and Vision, vol. 3, article 16, 2016.

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9. E. Yuksef, D. Yalinbas, B. Adin, K. Bilgihan: Keratoconus progression induced by IVF treatment. J Refract Surg. 2016

10. F. Hoogewoud, Z. Gatziofias, F. Hafezi. Transitory topographical variations in keratoconus during pregnancy. J refract Surg. 2013

11. D. Tabibian et al. Pregnancy-induced Changes in Corneal Biomechanics and Topography Are Thyroid Hormone Related. Am J Ophthalmol 2017



What about assisted reproductive technology (ART) and IVF ? *Novel Consideration*

ART is associated with altered hormonal and epigenetic environments during early development.

The longer-term effects of IVF on offspring from childhood to adolescence

[R J Hart](#)^{1,2,3,*}, [L A Wijs](#)¹

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PMCID: PMC9773093 PMID: [36570043](#)



ART and KCN

- Limited data on long-term corneal outcomes
- ART associated with altered hormonal and epigenetic environment
- Possible interaction with genetic susceptibility

Keratoconus Progression Induced by In Vitro Fertilization Treatment

Erdem Yuksel, Duygu Yalinbas, Bahri Aydin, Kamil Bilgihan

PMID: 26812716

DOI: [10.3928/1081597X-20151207-10](https://doi.org/10.3928/1081597X-20151207-10)

While its systemic effects are well studied, its potential influence on corneal development and biomechanics remains largely unexplored.

Subclinical Keratoconus Detection in Identical Twins

¹Gustavo Guerra, ²Vitor Buchmuller de Oliveira, ³Ivan Ferreira, ⁴Isaac Ramos, ⁵Michael W Belin
⁶Renato Ambrósio Jr

Hit Hypothe sis



- **First hit: Genetic predisposition**
- **Second Hit: Environmental or biological trigger:**
 - **Genetics x Hormones**
 - **Genetics x Inflammation**
 - **Genetics x Eyerubbing**
 - **Genetics x ART- related factors**

As it may lower the threshold for disease expression, allowing keratoconus to manifest unusually early.

Who's the culprit ?

- **Keratoconus is multifactorial**
- **No single factor to blame**
- **This case suggests that keratoconus arises from a complex interaction between genetic susceptibility and modifying biological and environmental factors.**
- **Genetics and the environment, partners in crime**



The youngest reported case of keratoconus in literature.

significant not only for
its rarity but for what it
forces us to reconsider.

doi: 10.3109/08820538.2013.874480. Epub 2014 Feb 7.

The Youngest Patient with Bilateral Keratoconus Secondary to Chronic Persistent Eye Rubbing

Alime Gunes¹, Levent Tok¹, Özlem Tok¹, Lütfi Seyrek¹

Corneal Cross-Linking in a 4-Year-Old Child With Keratoconus and Down Syndrome

Saad Sabti¹, Christoph Tappeiner, Beatrice E Frueh

Affiliations + expand

PMID: 26165788

DOI: [10.1097/ICO.0000000000000491](https://doi.org/10.1097/ICO.0000000000000491)

Keratoconus in a 4-year-old Girl with a Strong Family History of Keratoconus

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Take home message

Keratoconus can present much earlier than traditionally recognised, even with a normal clinical examination.

In high-risk children, advanced corneal imaging, biomechanical assessment, and family screening are essential.

Further studies are needed to clarify the role of ART and its implications for future screening, disease-modifying therapies, and pregnancy counselling

**This case reframes
the investigation,
transforming a case
closed into a case
opened and expanding
the boundaries of
current understanding.**

Thank you

