

What's true about Dua layer

Vincenzo Sarnicola, MD

Clinica degli Occhi Sarnicola, Grosseto, Italy

No financial interests to disclose



Human Corneal Anatomy Redefined

A **Novel** Pre-Descemet's Layer (*Dua's Layer*)

Harendra S. Dua, MD, PhD,¹ Lene A. Fong, MD, MSc,² Dahi G. Said, MD, FRCO, FRCOphth,³ Trisun Gray, MSc,⁴ James Lowe, MD, FRCPhth⁵



CORNEA

The Journal of Cornea and External Disease
www.corneajournal.com

REVIEW

Surgical Corneal Anatomy in Deep Anterior Lamellar Keratoplasty: Suggestion of New Acronyms

Enrica Sarnicola, MD,*†§|| Caterina Sarnicola, MD,† Albert Y. Cheung, MD,§||
Edward J. Holland, MD,|| and Vincenzo Sarnicola, MD†

(*Cornea* 2019;38:515–522)



Human Corneal Anatomy Redefined

A Novel Pre-Descemet's Layer (Dua's Layer)

Harinder S. Dua, MD, PhD,¹ Laxmi A. Faria, MD, MSc,² Disha G. Sood, MD, FRCO,³ Trivora Dey, MSc,⁴
Jitendra Lohia, MD, FRC(Ed)⁵

Ophthalmology 2013;120:1778-1785

BB Type 1

- Well circumscribed
- White edge
- Up to 8.5mm diameter (max 9.0 mm and then pops)
- Starts in the center and enlarge circumferentially
- Popping pressure 1.4-1.5 bar
- It is possible to peel off the DM without deflating the BB



“...BB 1 cleaves off a distinct layer at the posterior surface of the corneal stroma

Ophthalmology



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Ophthalmology 2013;120:1778-1785



BB Type 2

- Thin wall
- Clear edge
- 10 mm diameter
- Starts at the periphery
- Popping pressure 0.6 bar
- Peeling off the DM result in deflation of the BB
- New air injection, after the DM peeling, can create a BB type 1



“...BB type 2 cleaves off DM and stroma”



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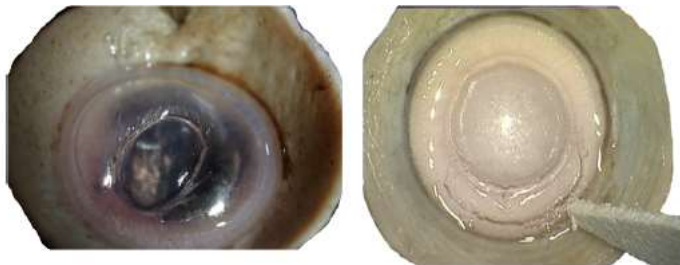
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BB Type 3

Cohexistence of BB type 1 and 2






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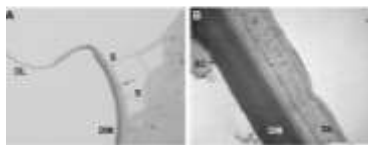
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Ophthalmology 2013;120:1778-1785



DUA'S LAYER

....BB 1 cleaves off a distinct layer at the posterior surface of the corneal stroma, which is not "residual stroma"
(Dua's Layer)




- HISTOLOGY:



- This layer is **acellular**
- Measured **10.15±3.6 microns**
- Composed of **5 to 8 lamellae** of predominantly type 1 collagen arranged in trasverse, longitudinal and oblique directions
- Smaller fibrils measure 21.70 ± 2.43 nm (24.20 ± 2.68 nm normal stroma, $P < 0.001$)


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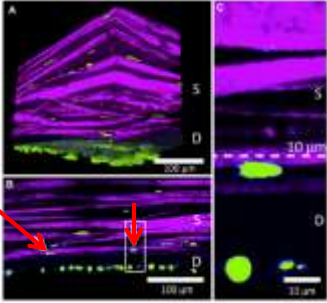
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Ophthalmology Volume 120, Number 9, September 2013



Editorial

Ophthalmology

Lessons in Corneal Structure and Mechanics to Guide the Corneal Surgeon
 James V. Jovan, PhD - Irvine, California
 Christopher J. McGly, DVM, PhD - Davis, California
 Moten Watkins, MS - Irvine, California
 Joe P.T. Hooper, PhD, DSc - Houston, Texas
 Donald Brown, PhD - Irvine, California
 Roger E. Stroman, MD - Irvine, California
 Mark J. Morris, MD - Davis, California

Ophthalmology Volume 120, Number 9, September 2013

“.....anathomic descriptions....demonstrate the **presence of keratocytes within 5 μm of the posterior lamina.** This observation runs counter to a supposed hallmark of this so-called new layer, that is acellularity.”

“Although the observations presented are novel and illuminate an important mechanical response to acutely introduced nonphysiologic strain, in our opinion, **The data presented do not warrant the assignation of a new anatomic layer to the cornea.**”


Re: Dua et al.: Human corneal anatomy redefined: a novel pre-Descemet layer (Dua's layer) (Ophthalmology 2013;120:1778-85)

Ophthalmology

1. **BB type 1 is intrastromal already demonstrated:**
 - JAFARINASAB in vivo in 2010
 - MCKEE in vitro in 2011
2. **2 types of BB already published**
 - ANWAR in 2002
3. **Bubbles burst pressure measurement flawed** (position of the needle)
4. **Medical eponyms should commemorate person's contribution**

different bubble types that can coexist.
 Their attempt to measure the burst pressure of the 2 different bubble types is fundamentally flawed. The needle was not advanced

MUZDEGAN R. KANAVI, MD¹
 SEPEHR FIZZI, MD²



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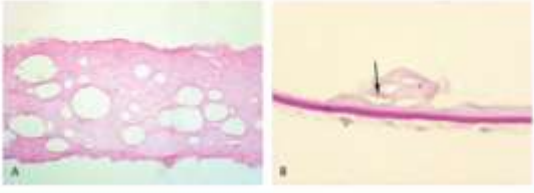
more regular and easily separated posteriorly in the cornea. One could expect that the lamellae lying on the smooth DM would be

2010

CORNEA
Official Journal of the American Society of Corneal Surgeons

Dissection Plane in Deep Anterior Lamellar Keratoplasty Using the Big-Bubble Technique

Mohammed Fata Zahraoui, MD, MSc; Richard Lauer, MD; Stephen Street Apsara, MD; and Saeed Aziz, MD



A B

SEPTEH FRIZI, MD

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2011

BJO

Residual corneal stroma in big-bubble deep anterior lamellar keratoplasty: a histological study in eye-bank corneas

Hassan D. Makoc, Luciano C. D. Lima, Peter M. Corley, Vishal Jhaeri and Azim K. Ibrahim



A B

C

Ophthalmology

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CORNEA

(Cornea 2002;23:374-383)




When the tip of the needle is situated in the desired place (Fig. 5), the plunger of the air-filled syringe is depressed until an effect is noted. This takes one of the following forms:

From One: Most commonly, after initially infiltrating part of the central-stromal disc, the air suddenly forms a large bubble with a close to circular outline, between DM and the deepest stroma (i.e., in the pre-Descemet plane). This is the desired result and is indicated by the sudden easing of resistance of the plunger of the syringe, as well as the "explosive" appearance of a whitish, semi-opaque disc, the edge of which may, but usually does not exactly coincide with the trephination groove (Fig. 6). The size of bubble depends on the amount of air that was injected. Pressure the plunger is immediately released and the needle is withdrawn.

From Two: Less frequently, the air just keeps infiltrating the central-stromal disc without a discernible bubble appearing, and a sudden easing of tissue resistance to the air injection. In this case, the somewhat denser whitish opacity leads the sharp, circular outline of the bubble. By the time that the air extends peripherally to the trephine groove, formation of a bubble is very unlikely and the surgeon should stop injecting air. This prevents some clear areas of central tissue (i.e., regions where the air has not yet penetrated) and also prevents air from entering the anterior chamber through the trabecular meshwork.²⁸

The formation of a large bubble (from one) is the result that the surgeon wants to generate by all means. In cases when the first attempt yielded merely a local, misty region of white, opaque stroma (from two), the needle is withdrawn and the surgeon may repeat the procedure, starting at another point on the periphery of the trephine groove where the cornea is still relatively clear. Because each attempt leaves a part of the tissue opaque, more than three or four sites are not likely to be feasible. When a big bubble does form, its usual, slightly bulging appearance is unmistakable (Fig. 6).

If the surgeon failed (even with additional air injections) to



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more regular and easily separated posteriorly in the cornea. One could expect that the lamellae lying on the smooth DM would be the most regular; hence, the dissection plane that forms above them. The findings of pneumodissection are consistent with known corneal stromal anatomy and do not require the existence of a new corneal layer to explain them.

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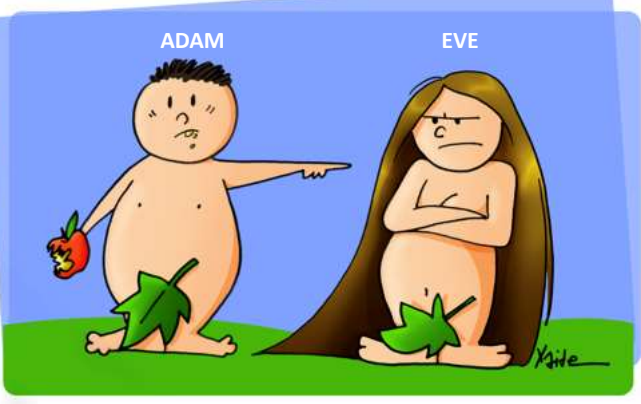
Ophthalmology Editorial

Who's on First!
Iran R. Schaub, MD - Sacramento, California



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3. Bubbles burst prior to surgery
4. Medical eponym

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Author reply

Dear Editor:
Thank you for the opportunity to respond to the letter by McKee et al. They make 3 points: 1) McKee et al. state that the layer was not present in the posterior cornea, and that the pre-Desmet's layer, as named in our paper, is located predominantly at the periphery and spread across the entire posterior surface of the cornea. They did not demonstrate any of these, yet they claim that what we demonstrated is what they have previously demonstrated. The fact, as we see it, is that the penny did not drop for them. They further claim the incorrect type '1'

2014

1. REGRET USING EPONYM
2. EXCHANGE "DUA'S LAYER" WITH "PRE-DESCMET'S LAYER" (PDL)
3. JAFARINASAB and MCKEE WERE CITED IN HIS PAPER
4. VINDICATE ORIGINAL DESCRIPTION OF BB TYPE 1 and 2 BEHAVIOUR
5. CITED 2007 SICSSO MEETING and ROYAL COLLEGE MEETING
6. NO COMMENT ON THE POPPING PRESSURE STUDY METHOD
7. VINDICATE HISTOLOGIC DESCRIPTION OF DUA'S LAYER TO BE UNIQUE


This is not a distinct layer but merely 'residual stroma.' We have returned, in our published paper, the papers quoted by the authors that were published before our submission in August 2012. To set the record straight, we had presented our data with *in vivo* bubbles and clinical and electron micrographic images of the "PDL" in 2 international meetings, including one in the largest eye meeting in the United Kingdom, several years before their first paper describing the presence of "residual stroma." Up until our paper was published, the accepted explanation for the appearance of 2 bubbles was a "split between banded and non-banded zones" of the Desmet's membrane (DM). The concept that "residual" bubbles could occur did not exist and has not been explained in any of the other papers published.

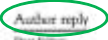
Although Jafarinasab et al. and then McKee et al. published the presence of "residual stroma," they did not characterize it. We showed that the PDL separates into >9 mm in diameter type 1 bubbles, that is covered mostly by the accumulation of several small bubbles and expands centrifugally, that it extends to the periphery but is freely adherent to the posterior stroma, that it is impervious to air, that the DM can be peeled off the type 1 bubble without deflating it, that the presence of DM is not essential for the

formation of type 1 or 2 bubbles. We further explained that this part of the posterior stroma, the PDL, is influenced by the endothelial cells, which could explain the differences between it and the posterior corneal stroma.

Associated evidence of the role of the PDL in posterior corneal pathology, as hypothesized in our published paper, is already beginning to emerge. A surgical cause of the PDL, occurring a deermecroble as we had predicted has been sent to us by Dr. Tarek Karameh from Cairo. Many surgeons have written to us with their experience, images, and videos supporting the PDL as a distinct part of the surgical anatomy of the cornea. Our own work on further characterization of the PDL will appear in the literature in due course. More is yet to come and, through the process of questions, challenges, and debate (with documents), may the truth emerge.

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2014



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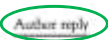
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CLINICAL SCIENCE

(Cornea 2010;29:53–59)

Descemetic DALK and PreDescemetic DALK: Outcomes in 236 Cases of Keratoconus

Finanza Sarnicola, MD,* Patricia Torn, MD,* Domenico Gentile, PhD,† and Sadeer B. Hamzah, MD‡

METHODS

Between September 2000 and September 2006, 236 eyes of 198 patients affected by moderate to advanced keratoconus, who were intolerant to contact lenses and had poor spectacle-corrected visual acuity, underwent DALK. A total of 38 patients were treated with this procedure in both eyes.

Different dissection techniques, such as “divide and conquer,” hydrodelamination, viscodissection, and air dissection, were progressively introduced to successfully accomplish this procedure. All the procedures aimed at achieving DM exposure. For descemetic DALK (dDALK), we exposed a thin and transparent DM, with its unequivocal intraoperative bright and uniform appearance. For **preDescemetic DALK (pdDALK)**, we performed very deep lamellar surgery, where a very thin **stromal layer of almost constant thickness is left behind**, without the complete exposure of the DM (Fig. 1A and B).

(dDALK)

(pdDALK)



FIGURE 1. A, Intraoperative bright and regular clinical aspect of Descemet membrane after complete stromal removal in dDALK. B, Clinical aspect of a preDescemetic plane in pdDALK.

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Ophthalmology

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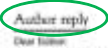
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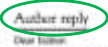
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 without deflating it, that the presence of DM is not essential for the


possibly accommodating a greater amount of proteoglycans,
 could contribute to making it airtight.

In 2002, Hirano et al¹⁴ identified a layer attached to the
 deep stroma removed by mechanical dissection. They
 attributed this to a split between banded and nonbanded
 layers of the DM. With their BB technique, Anwar and
 Teichmann³ demonstrated that a white, semiopaque,
 circular ring in the cornea indicated the formation of the
 BB. Later, they described another less common type of
 bubble with the clear edge, which they suggested was
 because of air between the 2 layers of the DM.¹⁵
 Jafarinasab et al¹⁶ in 2010 described "residual stroma"
 adherent to the DM in samples removed after attempted
 BB-DALK converted to penetrating keratoplasty. Simi-
 larly, McKee et al^{11,12} created a BB in human sclerocorneal
 discs by injecting air from the anterior and posterior surfaces.
 They also demonstrated "residual stroma" attached to the
 DM in all but 2 cases. Both studies concluded that the BB
 technique does not bare the DM in most cases, with the split



2014

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2. **EXCHANGE "DUA'S LAYER" WITH "PRE-DESCEMET'S LAYER" (PDL)**
3. **JAFARINASAB and MCKEE WERE CITED IN HIS PAPER**
4. **VINDICATE ORIGINAL DESCRIPTION OF BB TYPE 1 and 2 BEHAVIOUR**
5. **CITED 2007 SICSSO MEETING and ROYAL COLLEGE MEETING**
6. **NO COMMENT ON THE POPPING PRESSURE STUDY METHOD**
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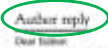
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that this part of the posterior stroma, the PDL, is influenced by the
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Associated evidence of the role of the PDL in posterior corneal
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 Tarek Karacab from Cairo. Many surgeons have written to us
 with their experience, images, and videos supporting the PDL as a
 distinct part of the surgical anatomy of the cornea. Our own work
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 LARA A. FARUK, MD, MSc¹
 DALIA G. SAAD, MD, FRCS¹
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 JAMES LING, MD, FRCPATH³



Author reply

Dear Editor,
Thank you for the opportunity to respond to the letter by McKee et al. They make 3 points. I will address each of them, that they have written:

2014



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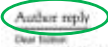
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JAMES LONG, MD, FRCS(ophth)³



12

Human Corneal Anatomy Redefined

A Novel Pre-Descemet's Layer (Dua's Layer)

Harendra J. Dua, MD, PhD,¹ Ganu A. Fong, MD, MSc,² Daba G. Said, MD, FRCO, FRCOphth,³ Trivish Trivan, MSc,⁴ Janus Low, MD, FRCPath⁵



Ultrastructure of the Posterior Corneal Stroma

Ophthalmology



Ursula Schlotzer-Schuchardt, PhD,¹ Bjoern O. Baehare, MD,² Thoralf Trivan, MD,³ Andy A.M. Torricelli, MD,⁴ Aron Imsh, MD,⁵ Shadi Ghazizadeh, MD,⁶ Hao Mei, PhD,⁷ Sophie X. Dong, MD,⁸ Justin E. Wilson, MD,⁹ Frederick B. Arora, MD¹⁰

Ophthalmology 2015;122:693-699

Schlotzer-Schuchardt et al • Posterior Corneal Stroma



Observational consecutive series
3 independent examiners

29 sclerocornea discs:

- 19 Fresh
- 10 Organ cultured
obtained after DMEK

“.....clearly argue against the existence of a distinctive acellular posterior layer”

FINDINGS:

1. Presence of **keratocytes at 1.5 μm from DM** (central cornea) and **5-9 μm** (periphery)
2. **Lamellae number not constant**
3. **Fibrils diameter is not smaller**
4. **Thickness of the new supposed layer is not constant** but has a 3-folds variation
5. **Dua's observations refer to the pre-DM anchorage zone**

CORNEA

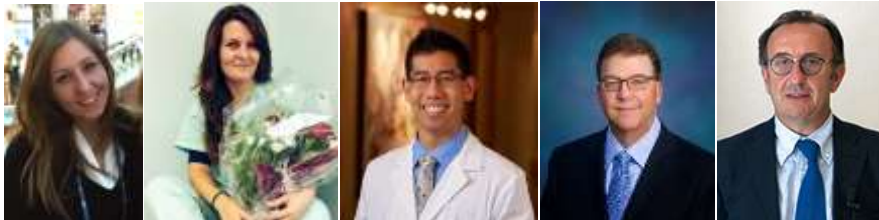
The Journal of Cornea and External Disease
www.corneajournal.com

REVIEW

Surgical Corneal Anatomy in Deep Anterior Lamellar Keratoplasty: Suggestion of New Acronyms

Enrica Sarnicola, MD,*†§|| Caterina Sarnicola, MD,† Albert Y. Cheung, MD,§||
Edward J. Holland, MD,|| and Vincenzo Sarnicola, MD†

(*Cornea* 2019;38:515–522)



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CORNEA


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Dimitri Sarrafidis, MD, FRCOphth (Cornea), Sarrafidis, MD, FRCOphth (Cornea),
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Surgical Corneal Anatomy in Deep Anterior Lamellar Keratoplasty: Suggestion of New Acronyms
 Daria Sarricola, MD, PhD, Cornea Service, MSF (Barry T. Chong, MD, FRCOphth),
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CORNEA
 The Journal of Cornea and Contact Lens

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- BB type 3 was first described by Dua



Surgical Corneal Anatomy in Deep Anterior Lamellar Keratoplasty: Suggestion of New Acronyms
 Devraj Sankrishi, MD, MS (Fellow Cornea Society, MS, FRCOphth, FRCOphth),
 Edward J. Holland, MD, and Devraj Sankrishi, MD

(Cornea 2019;38:515–522)



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- Histological description of BB type 2 was first described by McKee et al.
- The existence of the Dua's layer has not been confirmed in the literature
- BB type 3 was first described by Dua
- Bubbles behavior and surgical/pathophysiological implications were well elucidated by Dua

UNDOUBTED ADVANTAGES OF DUA'S INVESTIGATION

1- Classification of BB Type 1, Type2 and Type 3

- Dangerousness of BB Type 2
- Maximum diameter of BB Type 1
- Visual outcomes
- Characteristics of DM ruptures



VERY IMPORTANT PRACTICAL APPLICATION

- Acute nydriops in keratoconus
- Resistance of Descemetocle before perforation
- Recurrence of Macular dystrophy after BB Type 1
- Ect.



“Despite the existence of a new **anatomical layer** is not confirmed. . . .



...there is no denying that It is a **“surgical plane”**

Vincenzo Sarnicola

Asia Cornea Society, Seoul December 2016



pdDALK
Bed thickness <80μ

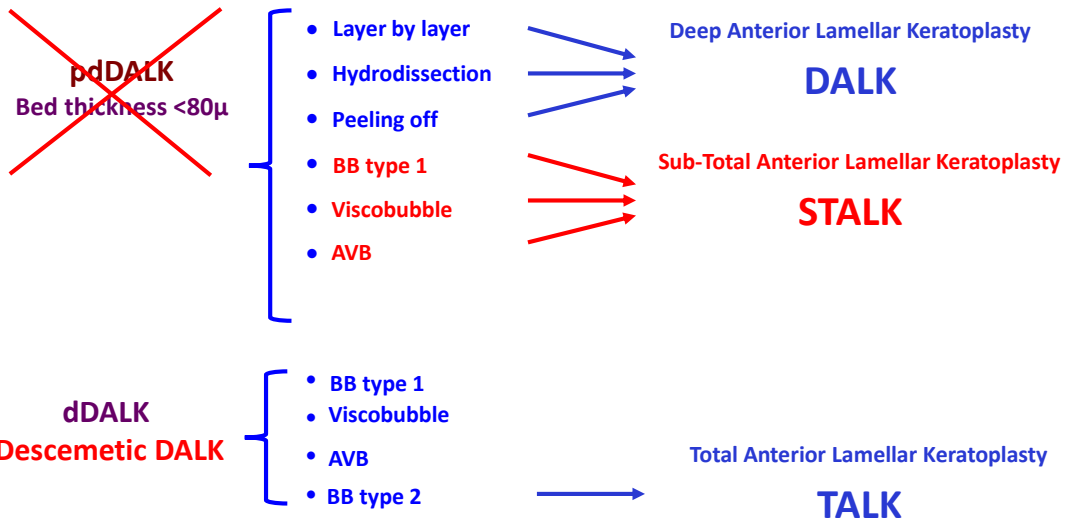
- Layer by layer
- Hydrodissect
- Peeling off
-
-
-

dDALK

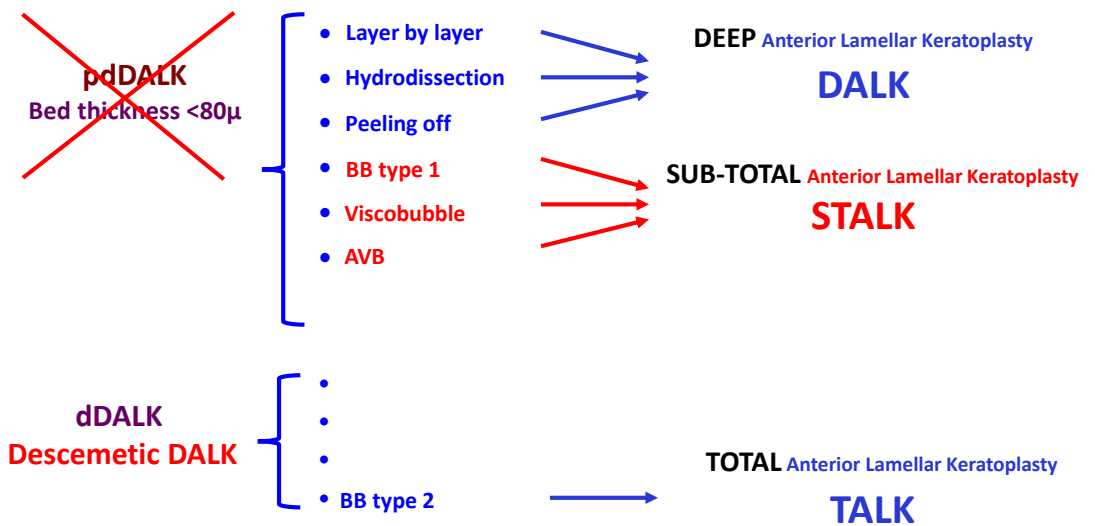
- BB type 1
- Viscobubble
- AVB
- BB type 2

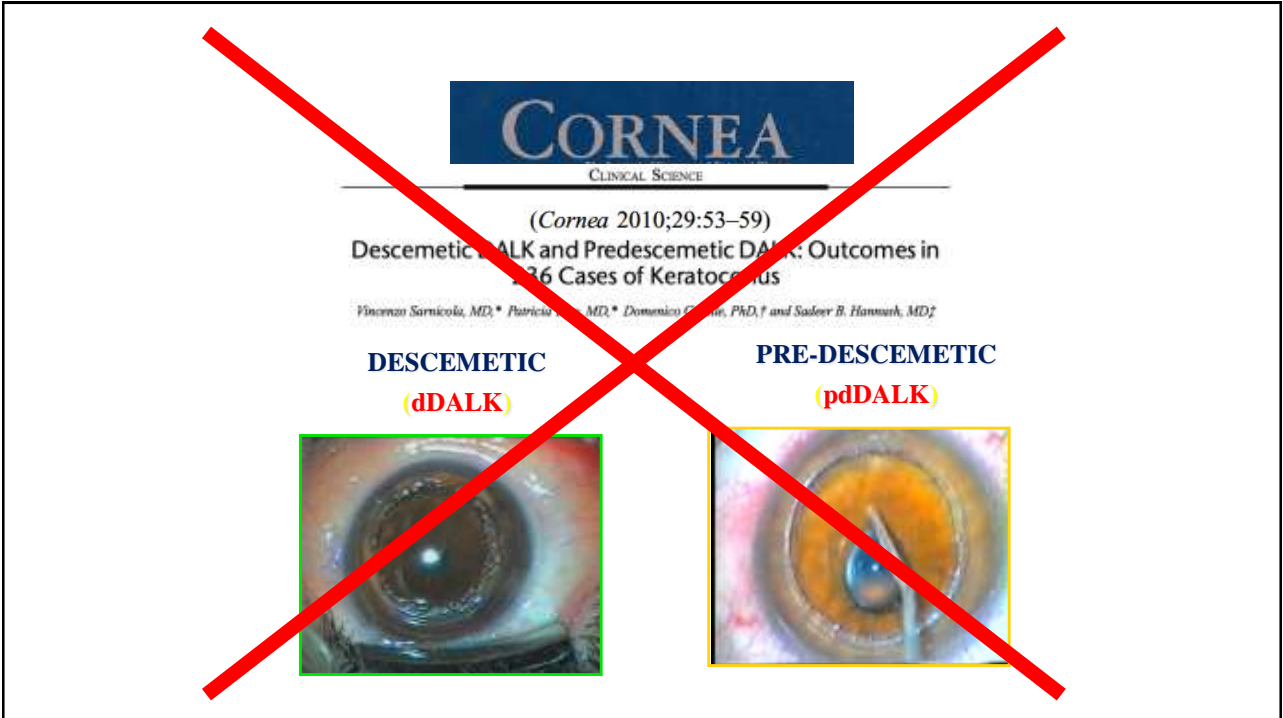


HISTOLOGICAL CLASSIFICATION



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<p>CORNEA The Journal of Cornea and External Disease</p> <p>Surgical Corneal Anatomy in Deep Anterior Lamellar Keratoplasty: Suggestion of New Acronyms</p> <p>(<i>Cornea</i> 2019;38:515–522)</p>	
<p>DALK</p> <p>Deep Anterior Lamellar Keratoplasty</p>	<ul style="list-style-type: none"> Manual dissection (pdDALK) Layer by layer (pdDALK) Hydrodissection (pdDALK) Peeling off (pdDALK) Ect. (pdDALK)
<p>STALK</p> <p>Sub-Total Anterior Lamellar Keratoplasty</p>	<ul style="list-style-type: none"> BB type 1 (wrongly called dDALK) Viscodissection (wrongly called dDALK) AVB (airviscububble) (wrongly called dDALK)
<p>TALK</p> <p>Total Anterior Lamellar Keratoplasty</p>	<ul style="list-style-type: none"> BB type 2 (dDALK)

Residual bed < 80 μm

10.00 - 11.00: DALK & LIVE SURGERY**PRESIDENT:** *V. Sarnicola (Grosseta)***ROUND TABLE:** *A. Galun (Padova), T. Katamish (Egypt), W. B. Lee (USA), M. Terry (USA), J. Shimazaki (Japan), S. Shimamura (Japan), P. Vinciguerra (Milan)***LIVE SURGERY - DALK**

+ **STREAMING FROM:** *Ospedale Oftalmico di Torino (Turin)*
 + **SURGEONS:** *R. Faglia (Italy)*
 + **MODERATOR FROM OR:** *R. Vinciguerra (UK)*



• **DALK surgical anatomy and new acronym: Dua Layer, DALK, STALK, TALK**

V. Sarnicola (Grosseta)

• **Clinical and surgical applications of "pre-Descemet's layer"**

H. S. Dua (USA)



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MAIN ROOM CAVOUR

MAIN ROOM CAVOUR

39

**Presenter:** *J. B. Rubenstein (USA)***MARIAN S. MACSAI, MD (USA)****Mental Lecture 2019**

"Eye banking and new corneal surgeries, what we have and what we need"

Dr. Macsai is the chief of the Division of Ophthalmology for NorthShore University HealthSystem and clinical professor of ophthalmology at the University of Chicago, Pritzker School of Medicine. She is the past President of the Cornea Society as well as past Chair of the Eye Bank Association of America. She has been active in eye banking at the national level for over 20 years.

Dr. Macsai is a board-certified ophthalmologist with fellowship training in cornea and refractive surgery. Her areas of expertise include corneal transplants, refractive surgery, contacts, as well as medical and surgical treatment of diseases of the external eye. Dr. Macsai is a member of the American Ophthalmologic Society with thesis and serves as an examiner for the American Board of Ophthalmology. She has served on the Food and Drug Administration Ophthalmic Device Panel and currently serves on the Advisory Committee on Blood and Tissue Safety and Availability (ACBTTSA) as well as serving on the World Health Organization Donorship and Surveillance Committee.

She is nationally recognized as an expert in the fields of refractive and corneal surgery and has served as a guest speaker and visiting professor at numerous academic institutions, both in the United States and internationally.

She has been the recipient of numerous honors and awards including the Pritzker Award, Distinguished Contributions in Medicine Award, and other outstanding teaching and education awards. She was Foran's Gift of Sight Honoree in 2010. In 2017, she received the Lifetime Achievement Award from the American Academy of Ophthalmology.

She serves on the executive editorial board of the journal *Cornea*, and has edited the textbooks series *Rapid Diagnosis in Ophthalmology and Ophthalmic Microsurgical Suturing Techniques*. More recently her article, The use of Topical Fluorouracil in the Treatment of Pterygia Development after Descemet's Stripping Only, is in publication.

FRIDAY 10^{PM}**Presenter:** *W. B. Lee (USA)***ELMER Y. TU (USA)****Mental Lecture 2019**

"Prevention and management of corneal transplant – related infections"

Elmer Y. Tu, MD is a Professor of Clinical Ophthalmology and Director of the Cornea and External Disease Section of the Department of Ophthalmology and Visual Science, University of Illinois College of Medicine, Chicago, Illinois. He received a BS in Chemistry from the University of Illinois in 1984 and an MD from the University of Illinois School of Medicine in 1989. He completed an Ophthalmology residency at the University of Wisconsin, Madison in 1992 and a fellowship in Cornea and External Disease at the Barrow, Palmer Eye Institute in 1993. He was formerly Director of the Cornea and External Disease Section, Department of Ophthalmology, University of Texas Health Science Center, San Antonio, San Antonio, Texas until 1999 and served as Residency Program Director. His areas of research interest involve infectious and inflammatory diseases of the ocular surface, contact lens safety, corneal surgery and eye banking.

Dr. Tu is a recipient of both an American Academy of Ophthalmology Achievement Award and 3 Sclerotic Awards. He was elected to the Alpha Omega Alpha Honor Society and has been listed as expert consultant to the FDA Ophthalmic Device Panel. He serves on the ACPD Fellowship Compliance Committee and previously served on the American Academy of Ophthalmology Basic and Clinical Science Course Cornea/External Disease Subcommittee and Knowledge Base-Cornea/External Disease Panel Subcommittee. He currently serves as President of the Cornea Society and is a past President of the Ocular Microbiology and Immunology Group. He is an Executive Editor for Cornea and External Disease for the American Journal of Ophthalmology, served as a Section Editor of the AAO publication, *Focal Points*, and is a member of the Editorial Board of the subspecialty journals *Cornea* and *Eye and Contact Lens*. He performs peer reviews on a regular basis for numerous national and international journals. He has also received numerous teaching awards, presented numerous national, regional and international invited lectures and has been listed as a Best Doctor in America for over 15 years. In total, he has over 100 book chapters, peer-reviewed manuscripts, and abstracts in publication.

FRIDAY 10^{PM}

LIVE SURGEONS

Row 1: G. Alessio (Italy), A. Bellini (France), F. Figue (India), E. J. McLeod (USA)

Row 2: W. Lee (USA), W. B. Lee (USA), V. Maresio (UK), A. Mithras (Rep. of San Marino)

Row 3: Leopoldo Spadea, F. Price (USA), B. Preri (France), V. Santavirta (Finland)

Row 4: M. D. Straino (USA), M. Terry (USA)

WET LABS COURSES

Director: *A. Ruzza (Mestre, VE)*

Thursday 11.30 - 13.00 **CXL**
 Teachers: *Z. Szabo (Romania)*

Thursday 14.30 - 16.00 **DMEK**
 Teachers: *M. Terry & M. D. Straino (USA)*

Thursday 17.30 - 19.00 **DALK**
 Teachers: *R. Fogla (India) & U. De Sanctis (Turin)*

Friday 08.30 - 10.00 **DMEK**
 Teacher: *F. Price (USA)*

Friday 10.00 - 11.30 **DMEK**
 Teachers: *J. S. Mehta (Singapore)*

Friday 14.30 - 15.30 **DMEK DONOR STRIPPING**
 Teachers: *K. Marano (UK) & A. Ruzza (Mestre, VE)*

Friday 16.00 - 17.30 **DALK**
 Teachers: *S. Shimamura (Japan) & W.B. Lee (USA)*

Friday 18.00 - 19.00 **FEMTO-ASSISTED ISCR**
 Teacher: *A. Mularoni (Rep. of San Marino)*

Saturday 09.30 - 11.00 **DALK**
 Teachers: *J. Shimazaki (Japan) & T. Katamish (Egypt)*

Saturday 11.30 - 13.00 **AMNIOTIC MEMBRANE**
 Teachers: *A. Ntamo & P. Invernini (Cuneo)*

Live Surgery

THIS YEAR: LIVE SURGERY SESSIONS

WET LAB
Eye Bank Tissues

SICSSO CONGRESS
 The International Society of Cornea,
 Stem Cells and Ocular Surface

SAVE THE DATE
 27_29
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 2019

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Location:
PALAZZO REALE
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LEONARDO
DISEGNARE IL FUTURO
DA VINCI 1519
1019

SCOPERTE, CONFERENZE,
INCONTRI E LABORATORI DEDICATI
AL GENIO DI LEONARDO

