Preparazione di lamelle corneali per DSAEK

R. Ceccuzzi, M. Di Palma, G. Mantegna, M. Raneri

XXI Congresso Nazionale S.I.TRA.C.

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Cheratoplastica Endoteliale: storia

- 1956, Tillet → *EK* (per edema corneale in FECD)
- 1998, Melles → *PLK*, tramite procedura <u>manuale</u>
- 2001, Terry → modifiche, rinominandola *DLEK*
- 2001, Azar → possibilità d'uso di microcheratomo per preparare lamelle, tramite procedura <u>automatizzata</u>
- 2004, Melles → "*descemetorhexis*"
- 2005, Price → "*stripping*", rinominandola *DSEK*
- 2006, Gorovoy → costanza d'uso di microcheratomo per preparare lamelle, rinominandola *DSAEK*
- 2006, Melles → *DMEK*
- 2009, Busin → *UT-DSAEK*
- 2009, Price → *DMAEK*
- 2010 Studeny → *DMEK-S*
- 2013 Agarwald-(Dua) → *PDEK*

EK Vs PK

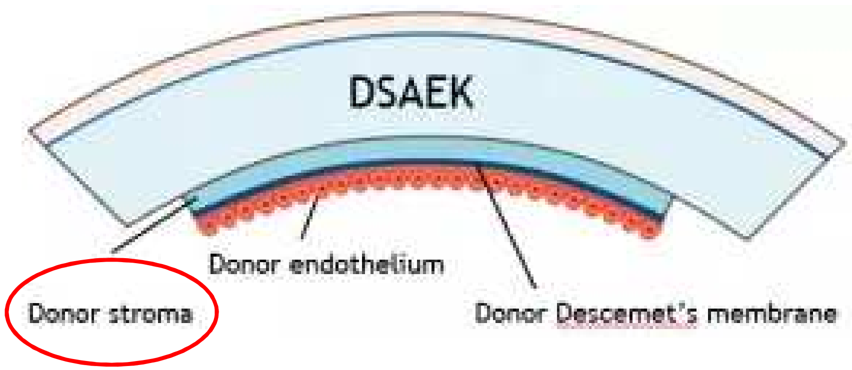
- incisioni a livello limbare
- complesso Descemet-endotelio rimosso dall'interno
- introduzione della lamella senza esposizione della AC

- **< R complicanze (infettive e immunologiche)**
- **più veloce e più cospicuo recupero visivo**

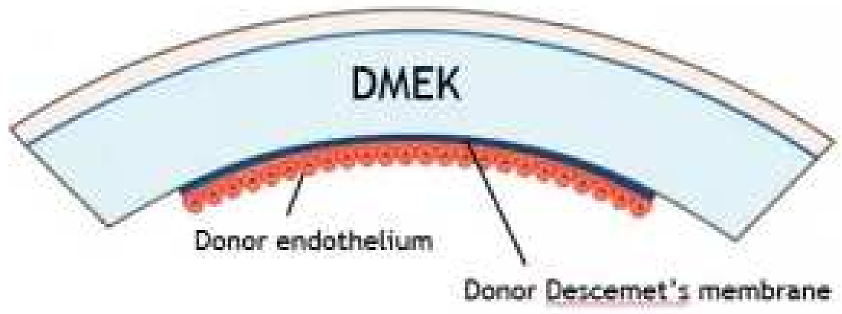
DS(A)EK vs DMEK

Descemet Stripping (Automated) Endothelial Keratoplasty*

(*se lamella preparata con microcheratomo/laser femtosecondi)



Descemet Membrane Endothelial Keratoplasty

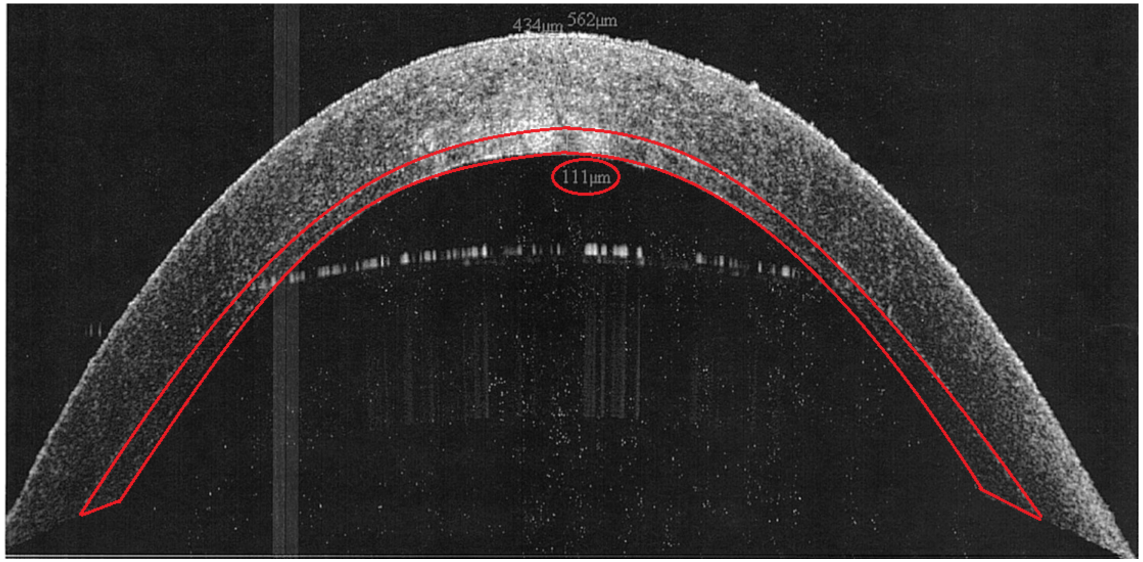


EK, Lembo "Ideale": quali caratteristiche?

- *superficie* regolare
  liscio

- *morfologia* regolare
  planare

- *spessore* regolare
  adeguatamente sottile



Fonte Immagine: Hawaii Lions EyeBank_Makana Foundation

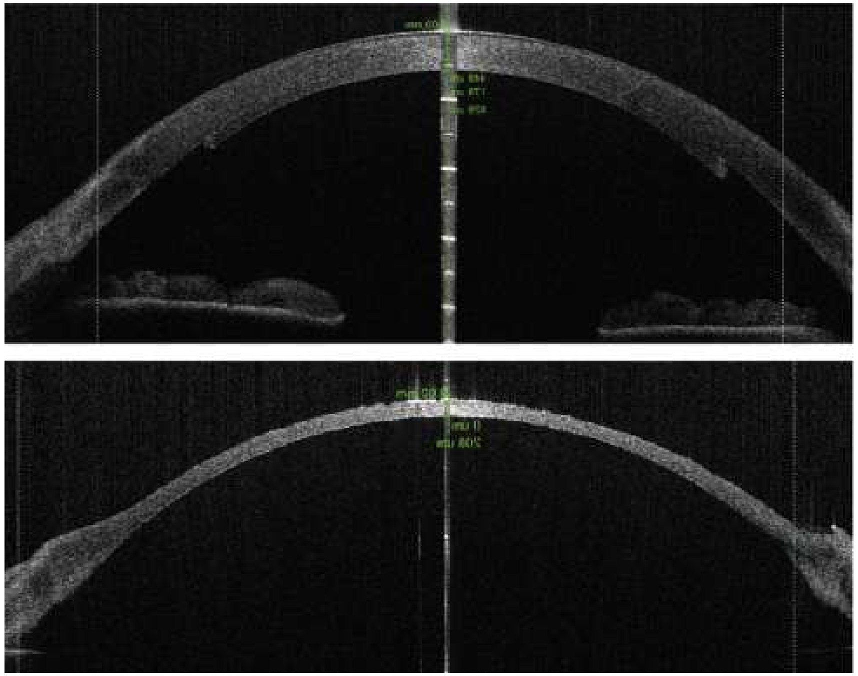
EK, Lembo “Ideale”: quale spessore?

“*Thick* enough for **manipulation**”

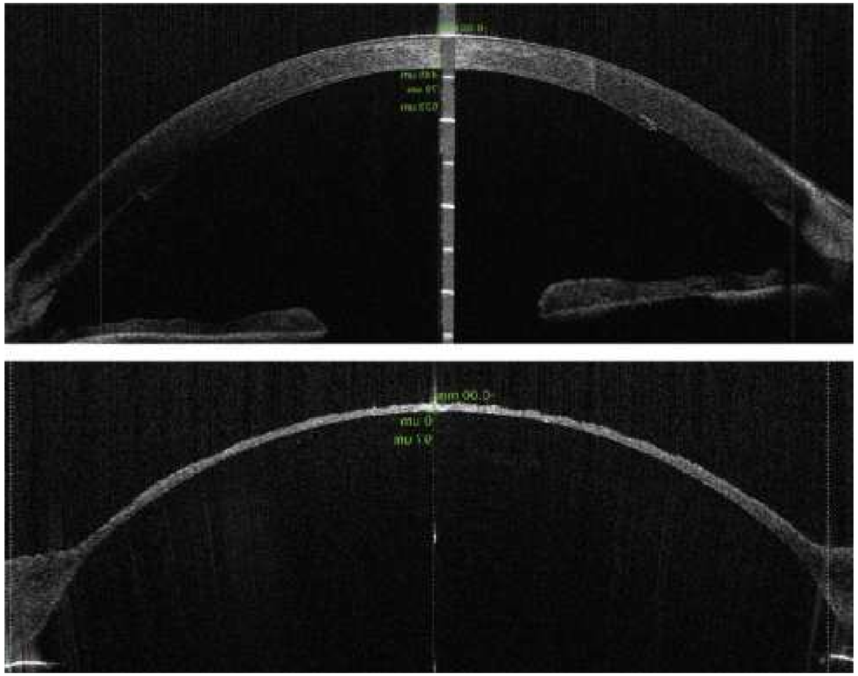
“*Thin* enough **when in place**”

DSAEK Vs UT-DSAEK

< 200 µm



< 130/100 µm



- Hsu et al, *Double-pass Microkeratome Technique for UT Graft Preparation in DSAEK* (2012)
- Busin et al, *Microkeratome-Assisted Preparation of UT-Grafts for DSAEK* (2012)
- Busin et al, *UT-DSAEK with Microkeratome Double-Pass Technique; Two-Year Outcomes* (2013)
- Woodward et al, *Relationship of Visual Acuity and Lamellar Thickness in DSAEK* (2013)
- Dickman et al, *A Randomized Multicenter Clinical Trial of UT-DSAEK Vs DSAEK* (2016)

Spessore & AV: letteratura (I)

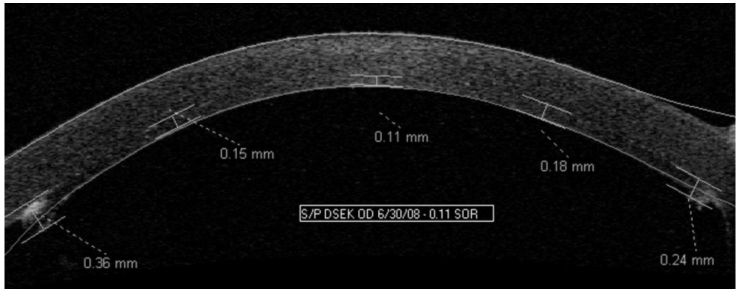
Comparison of Central Corneal Graft Thickness to Visual Acuity Outcomes in Endothelial Keratoplasty

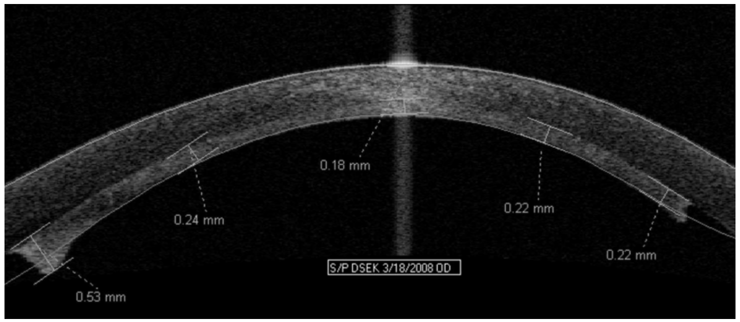
Kristiana D. Neff, MD, Joseph M. Biber, MD,†‡ and Edward J. Holland, MD†‡*

Cornea • Volume 30, Number 4, April 2011

Results: The median postoperative graft thickness of all eyes was 131 μm. The eyes were divided into 2 groups based on this median: thin EK (graft thickness: ≤131 μm; range: 77–131 μm; average: 109 μm) and thick EK (graft thickness: >131 μm; range: 138–182 μm; average: 162 μm). There was no statistically significant difference in age, sex, or preoperative best spectacle-corrected visual acuity (BSCVA) between the 2 groups. Average postoperative follow-up was 12.8 months. The thin EK group showed better postoperative BSCVA compared with the thick EK group ($P < 0.01$). All thin EK eyes had BSCVA greater than or equal to 20/25 with 71% of eyes achieving BSCVA of 20/20. In contrast, only 50% of thick EK eyes reached BSCVA greater than or equal to 20/25 with 19% obtaining BSCVA of 20/20.

Conclusions: Thin EK versus thick EK, as measured by AS-OCT in the postoperative period, showed a statistically significant improvement in BSCVA.





Spessore & AV: letteratura (II)

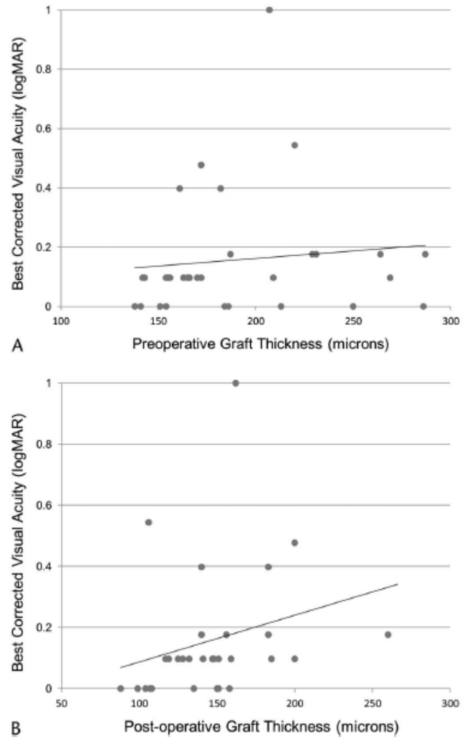
Relationship of Visual Acuity and Lamellar Thickness in Descemet Stripping Automated Endothelial Keratoplasty

Maria A. Woodward, MD, Duna Raoof-Daneshvar, MD, Shahzad Mian, MD, and Roni M. Shtein, MD, MS

Cornea • Volume 32, Number 5, May 2013

Results: Sixty-four eyes of 52 patients with a mean follow-up of 27 ± 16 months were included in the study. The mean preoperative GT of 199 ± 45 μm (range, 106–303 μm) was higher than the postoperative GT of 165 ± 53 μm (range, 88–335μm) (P < 0.0001). There was a moderate correlation of preoperative GT with postoperative GT (r = 0.41; P =0.0009). Mean Snellen visual acuity was 20/28 at 1 year and 20/29 at the final visit (r = 0.80; P < 0.0001). There was a poor correlation of best-corrected visual acuity at the final visit with preoperative GT (r = 0.11; P = 0.57) or with postoperative GT (r = 0.26; P = 0.16). Multivariate linear regression analysis indicates no association of either postoperative GT or best-corrected visual acuity at the final visit with donor tissue endothelial cell density, death-to-preservation time, death-to-surgery time, donor age, patient age, or length of postoperative follow-up.

Conclusion: GT decreased after transplantation; however, there was a poor correlation of visual acuity with preoperative or postoperative DSAEK GT.



Spessore & AV: letteratura (III)

Effect of Graft Thickness on Visual Acuity After Descemet Stripping Endothelial Keratoplasty: A Systematic Review and Meta-Analysis

KATRIN WACKER, WILLIAM M. BOURNE, AND SANJAY V. PATEL

AMERICAN JOURNAL OF OPHTHALMOLOGY MARCH 2016

• RESULTS: Of 480 articles and conference abstracts, 31 met inclusion criteria (2214 eyes) after full-text review. Twenty-three studies assessed correlations between BCVA and graft thickness, and 8 studies used different statistical methods. All associations were reported dimensionless. Studies generally had small sample sizes and were heterogeneous, especially with respect to data and analysis quality ($P = .02$). Most studies did not measure BCVA in a standardized manner. The pooled correlation coefficient for graft thickness vs BCVA was 0.20 (95% CI, 0.14–0.26) for 17 studies without data concerns; this did not include 7 studies (815 eyes) that used different statistical methods and did not find significant associations.

• CONCLUSIONS: There is insufficient evidence that graft thickness is clinically important with respect to BCVA after DSEK, with meta-analysis suggesting a weak relationship. Although well-designed longitudinal studies with standardized measurements of visual acuity and graft thickness are necessary to better characterize this relationship, current evidence suggests that graft thickness is not important for surgical planning. (Am J Ophthalmol 2016;163:18–28. © 2016 by Elsevier Inc. All rights reserved.)

Although we found a statistically significant pooled correlation between graft thickness and BCVA, the association was weak. At present, there is insufficient evidence to make robust conclusions about the magnitude of effect association or its clinical significance.

The current body of evidence does not suggest a strong association or clinically relevant relationship between graft thickness and BCVA after DSEK.

With respect to DSEK graft thickness, we agree with Terry and associates[16] that "graft thickness may have a small effect on visual outcomes in the extremes of thickness, but not in the common range of 100 µm to 200 µm" and that "donor thickness has a tenuous relationship with visual outcomes, accounting for only 5% of the variance in vision between patients, and should play a minimal role in surgical planning."

Spessore & AV: letteratura (IV)

Does thickness matter: ultrathin Descemet stripping automated endothelial keratoplasty

Massimo Busin[a] and Elena Albé[a,b]

Volume 25 • Number 4 • July 2014

Quite strikingly, the mean postoperative logMAR BSCVA curves of UT-DSAEK and DMEK almost overlap throughout the entire follow-up period considered, whereas one of the conventional DSAEK remains at a lower level [23,46].

On the basis of this report, in terms of 20/20 visual recovery, UT-DSAEK performs much better than conventional DSAEK as early as 1 year in the postoperative course, with about three times as many patients achieving 20/20 or better vision.

The visual outcome recorded after UT-DSAEK indicates that the use of thin grafts allows a higher number of eyes to achieve a better visual performance in a shorter period of time than after DSAEK.

After UT-DSAEK, a statistically significant ($P < 0.001$) hyperopic shift of about 0.75 D was found in the spherical equivalent. After DSAEK, several authors have reported a substantially higher significant hyperopic shift (up to 1.5 D) in the spherical equivalent [8,10,14,51,54]. The change in posterior corneal curvature caused by the attachment of a meniscus-shaped donor graft was the main cause of the hyperopic shift recorded.

A Randomized Multicenter Clinical Trial of Ultrathin Descemet Stripping Automated Endothelial Keratoplasty (DSAEK) versus DSAEK

Mor M. Dickman, MD,[1] Pieter J. Kruit, MD, PhD,[2] Lies Remeijer, MD, PhD,[3] Jeroen van Rooij, MD,[3] Allegonda Van der Lelij, MD, PhD,[4] Robert H.J. Wijdh, MD,[5] Frank J.H.M. van den Biggelaar, PhD,[1] Tos T.J.M. Berendschot, PhD,[1] Rudy M.M.A. Nuijts, MD, PhD[1]

Ophthalmology Volume 123, Number 11, November 2016

Results: Preoperative BSCVA did not differ between patients undergoing DSAEK (0.35 logarithm of the minimum angle of resolution [logMAR] [95% confidence interval {CI} 0.27–0.43]; n = 32) and UT-DSAEK (0.37 logMAR [95% CI 0.31–0.43]; n = 34; $P = 0.8$). BSCVA was significantly better after UT-DSAEK compared with that after DSAEK at 3 months (0.17 logMAR [95% CI 0.13–0.21], n = 31 vs. 0.28 logMAR [95% CI 0.23–0.33], n = 31; $P = 0.001$), 6 months (0.14 logMAR [95% CI 0.10–0.18], n = 30 vs. 0.24 logMAR [95% CI 0.20–0.28], n = 30; $P = 0.002$), and 12 months (0.13 logMAR [95% CI 0.09–0.17], n = 33 vs. 0.20 logMAR [95% CI 0.15–0.25], n = 29; $P = 0.03$). Refraction, ECD loss (40% at 3 months; $P < 0.001$), donor loss (DSAEK n = 2 vs. UT-DSAEK n = 3 [relative risk {RR} 1.4 {95% CI 0.24–7.5}; $P = 0.7$]), and graft dislocation (DSAEK n = 5 vs. UT-DSAEK n = 5 [RR 1.0 {95% CI 0.34–3.33}; $P = 0.9$]) did not differ between UT-DSAEK and DSAEK. Donor thickness was significantly thinner for UT-DSAEK (101 μm [95% CI 93–110 μm]; range 50–145 μm) than for DSAEK (209 μm [95% CI 196–222 μm]; range 147–289 μm; $P < 0.001$).

Conclusions: This study indicates that compared with DSAEK, UT-DSAEK results in faster and better recovery of BSCVA with similar refractive outcomes, endothelial cell loss, and incidence of complications.

Fattori condizionanti la preparazione delle lamelle

relati al *tessuto*

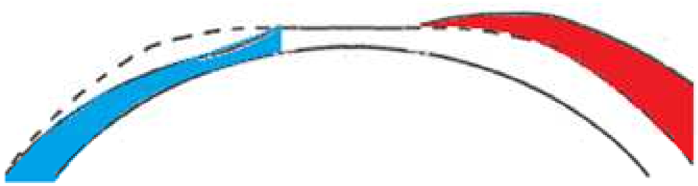
- bio-meccanica corneale (fattori intrinseci tessutali)

relati alla *procedura*

- pressione intracamerale “statica” <u>prima</u> del taglio
- pressione intracamerale “dinamica” <u>durante</u> il taglio
- direzione di taglio
- velocità di taglio

Pressione Intracamerale “Dinamica”

<u>senza</u> AAC Pressure Control



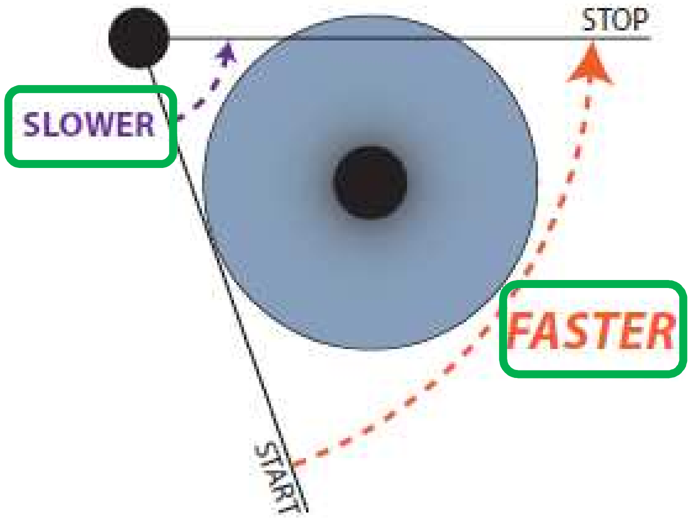
- ↑ P in AAC → <u>> ablazione</u> → **sottile**
- ↓ P in AAC → <u>< ablazione</u> → **spesso**

<u>con</u> *AAC Pressure Control*

- ≈ P in AAC → = ablazione → **omogeneo**

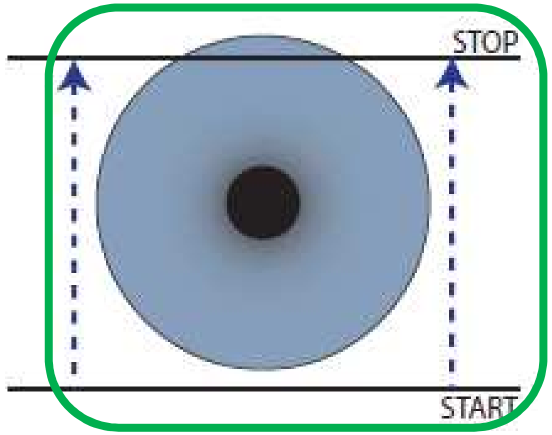
Direzione di Taglio

rotazionale



- movimento <u>prossimale</u> al fulcro *lento* → profondità di taglio <u>maggiore</u> → **spesso**
- movimento <u>distale</u> al fulcro *rapido* → profondità di taglio <u>minore</u> → **sottile**

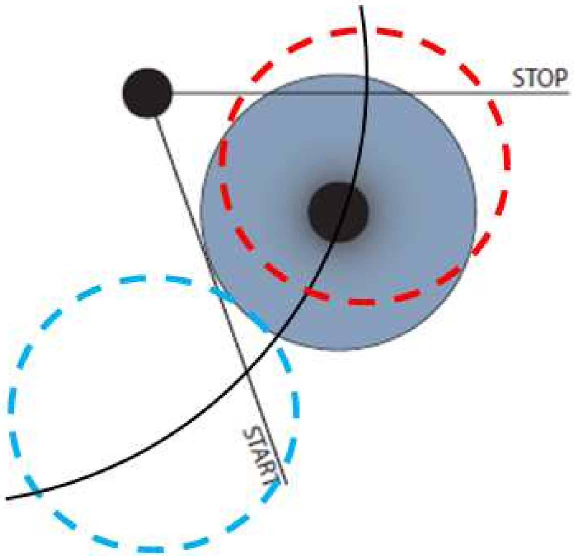
lineare



- movimento <u>uguale</u> → profondità di taglio <u>regolare</u> → **omogeneo**

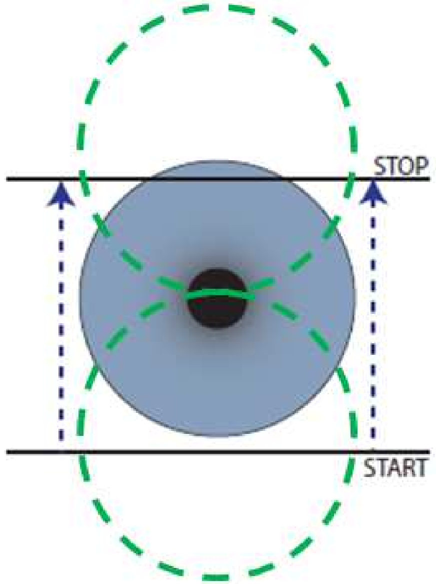
Velocità di Taglio

manuale



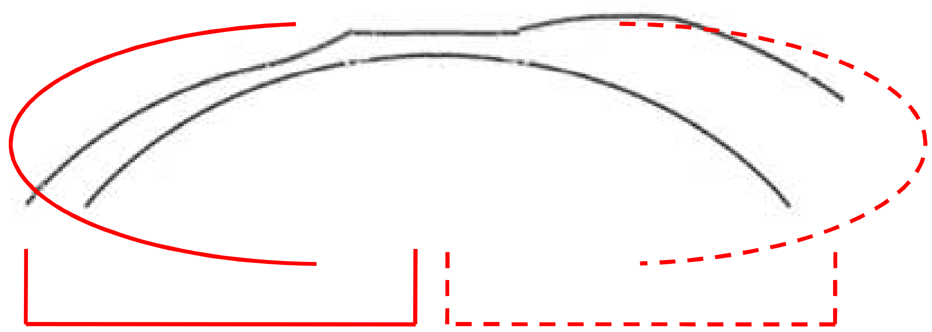
- movimento <u>iniziale</u> **rapido** ma movimento <u>finale</u> **lento**
- movimento <u>iniziale</u> **lento** ma movimento <u>finale</u> **rapido**

automatico



- movimento sia <u>iniziale</u> che <u>finale</u> **uguale**

EK, Lembo “Reale”: quale tolleranza?



- Δ spessore centro-periferia < 30%
- Δ spessore periferia-periferia < 10%

Fonte Dati: Banca Occhi del Veneto

Nostra Esperienza: obiettivi

studio retrospettivo

- *end-point* primari:
  - stimare lo scarto tra valori nominali delle lame utilizzate e taglio effettivo
  - analizzare gli spessori delle lamelle ottenute in base alle lame utilizzate
- *end-point* secondario:
  - valutare eventuali correlazioni tra i risultati conseguiti e fattori indiretti tessutali

↑ prevedibilità di spessore (→ qualità morfo-funzionali) delle lamelle

strumenti utilizzati

- microcheratomo:
  - lineare

  ***direzione* di taglio <u>costante</u>**

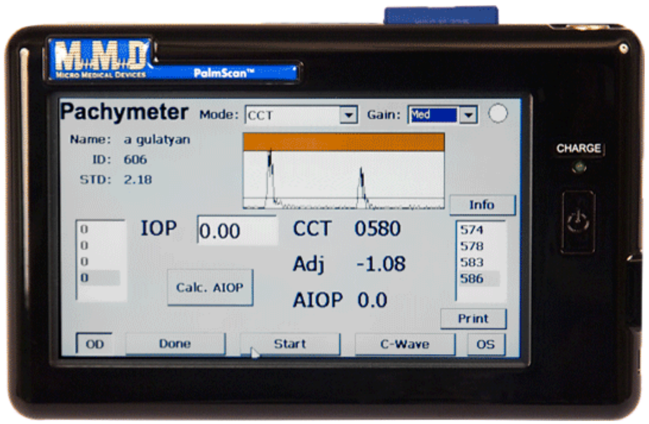
  - automatizzato

  ***velocità* di taglio <u>costante</u>**

  - a singolo passaggio

- pachimetro:
  - a ultrasuoni
  - a contatto
  - 2 modalità misurazione

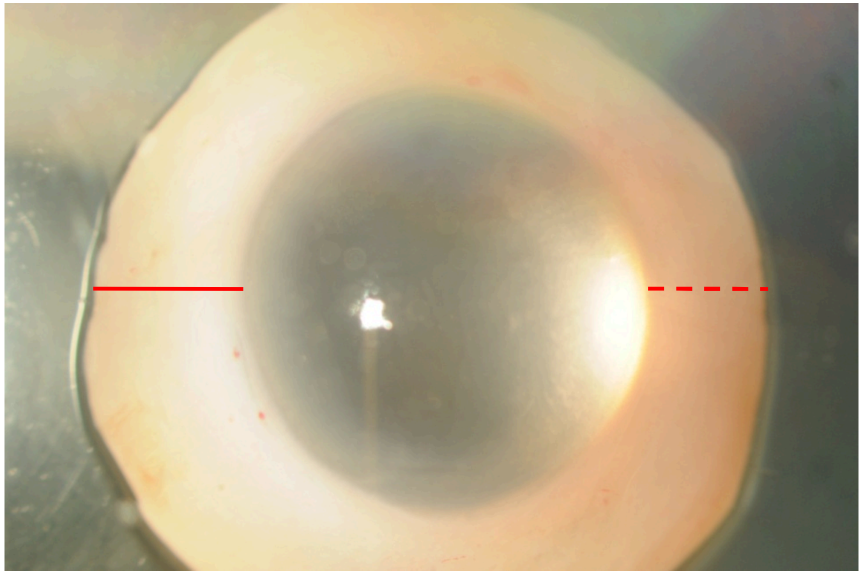
  (CCT e DSAEK)

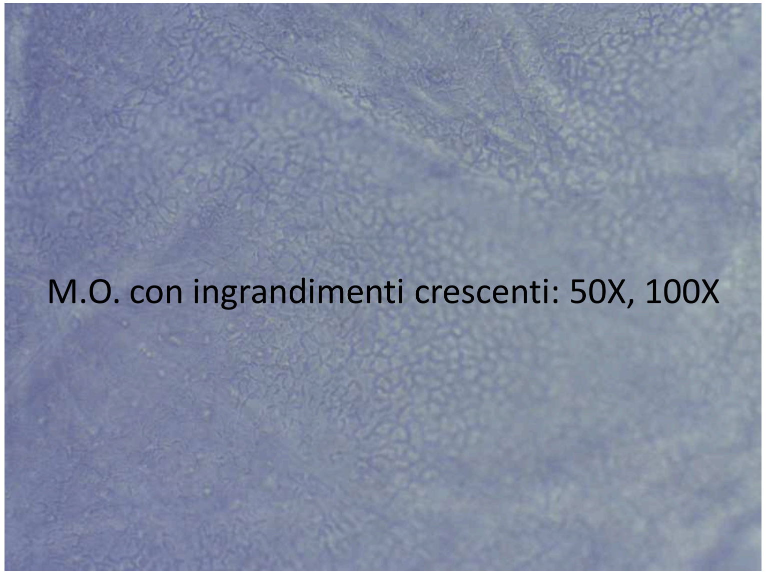


criteri inclusione

cut-off arbitrari:

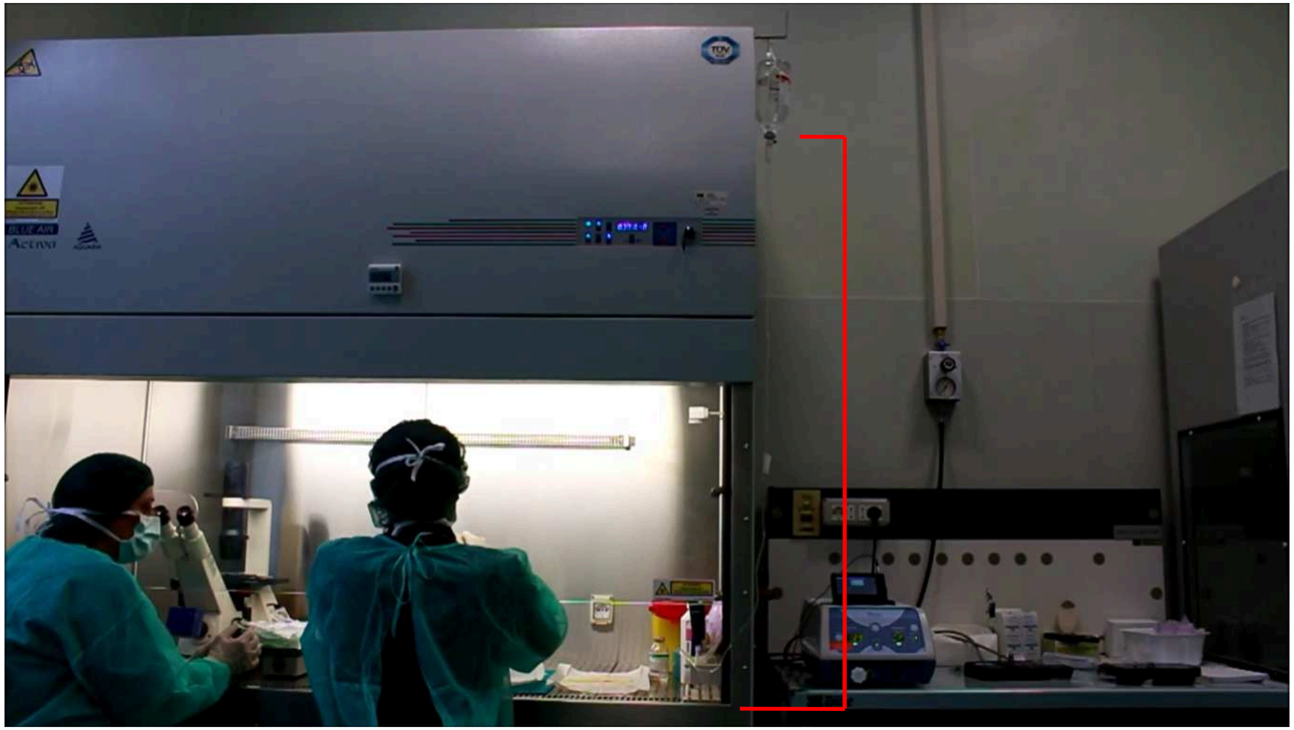
- anello sclerale ≥ 2 mm
- ECD > 2500 cell/mm^2
- n° cell Trypan Blue positive < 2,5% (0,25%: 0,1 ml per 1 min)





processo standardizzato

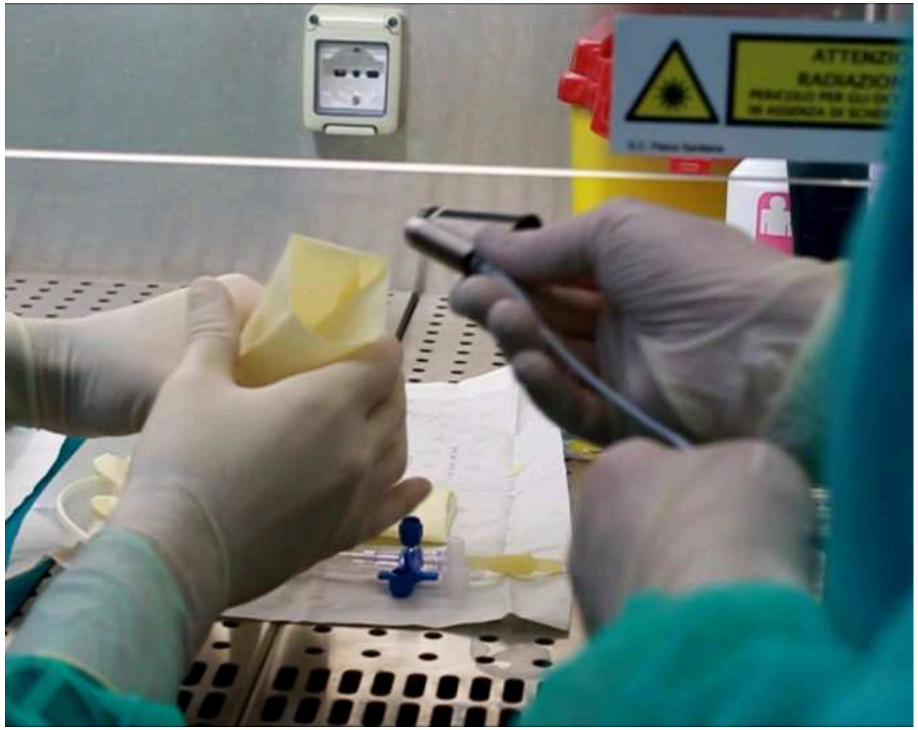
flebo con BSS a 120 cm dal piano di lavoro (= 90 mmHg)



→ ***pressione intracamerale "statica"*** **<u>costante</u>**

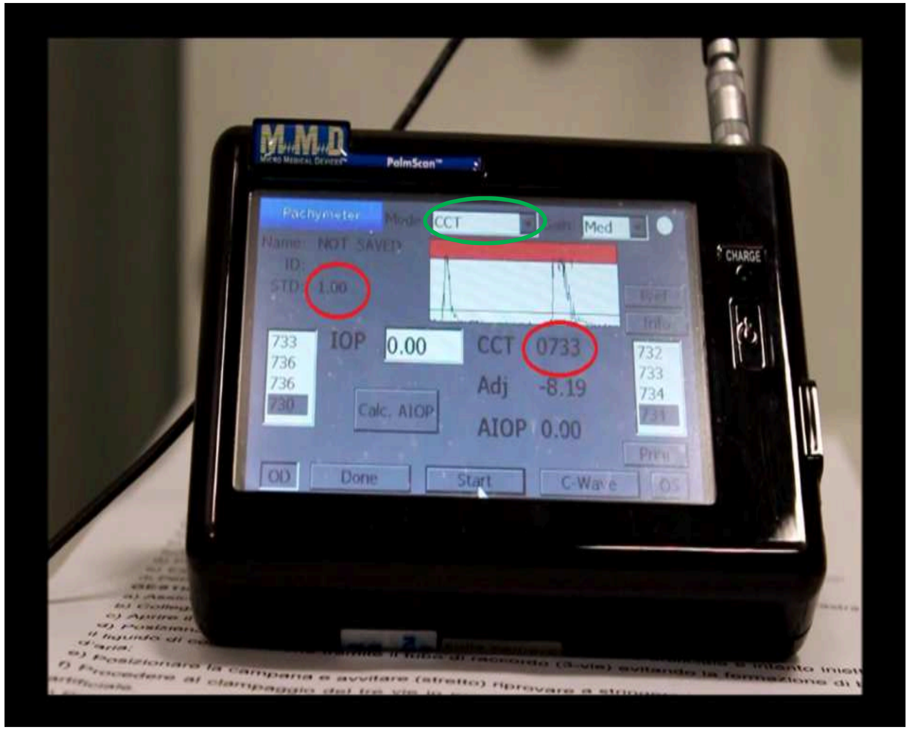
disinfezione e protezione del pachimetro

disinfezione e protezione del motore



cornea nel mezzo di deturgescenza
a T amb. per 24 h

misurazione spessore cornea libera su Capsula di Petri
(Pachi 1)

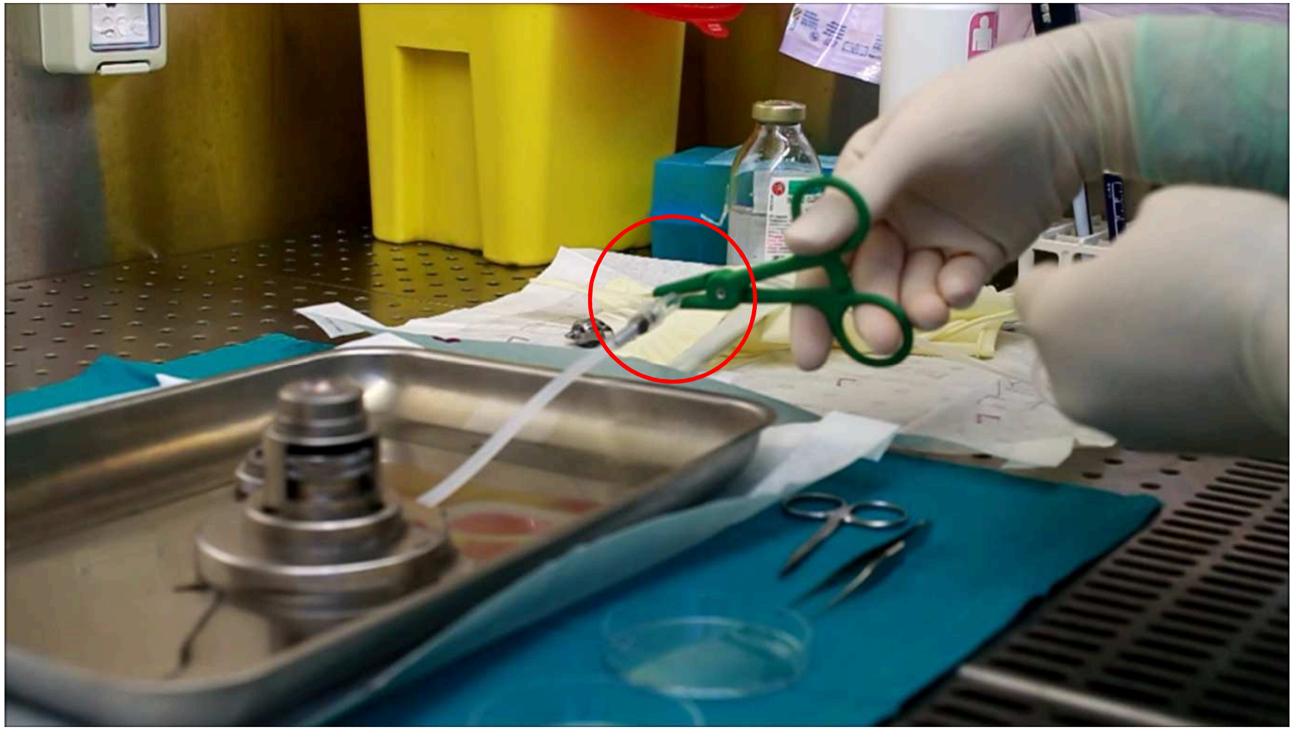


Pachimetro US in modalità <u>CCT</u>

posizionamento della cornea sulla camera artificiale

posizionamento della campana sulla cornea

<u>metodico</u> clampaggio del deflussore

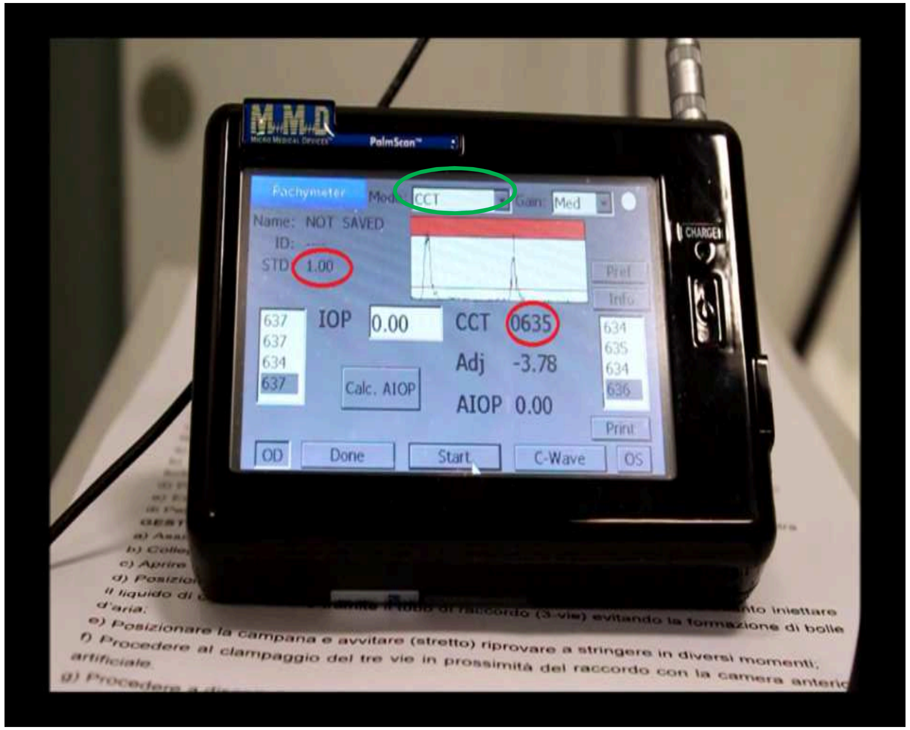


disepitelizzazione corneale
(con micro sponge)

marcatura corneale
(con penna dermografica)

posizionamento della slitta sulla campana

misurazione spessore cornea disepitelizzata in pressione (Pachi 2)



Pachimetro US in modalità CCT

posizionamento del motore
(con lama selezionata)

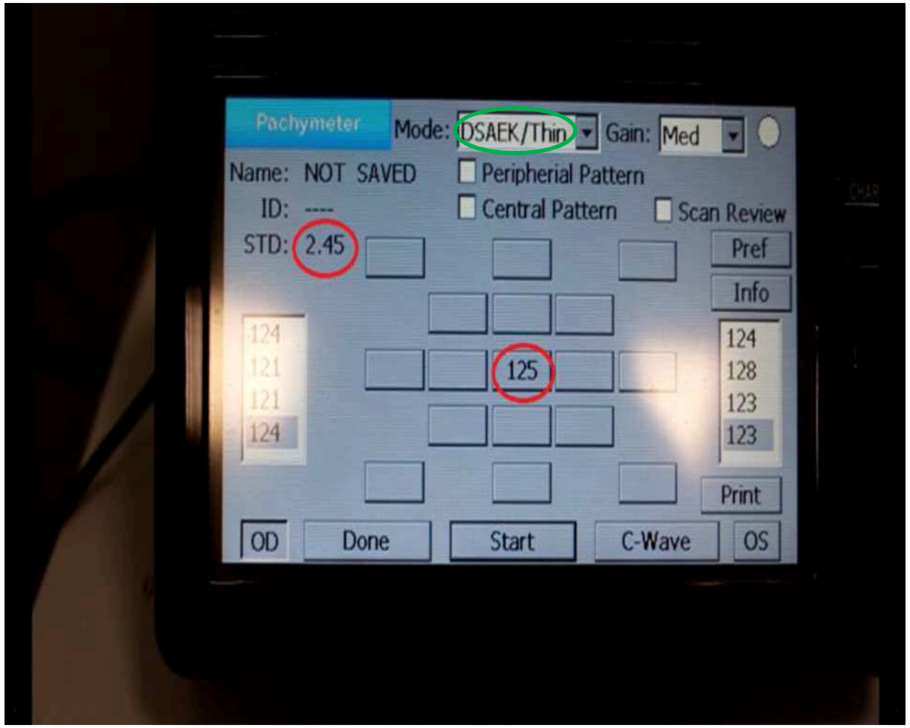
irrigazione
con BSS

esecuzione del taglio

(movimento anterogrado e retrogrado fino a <u>fine corsa</u>)

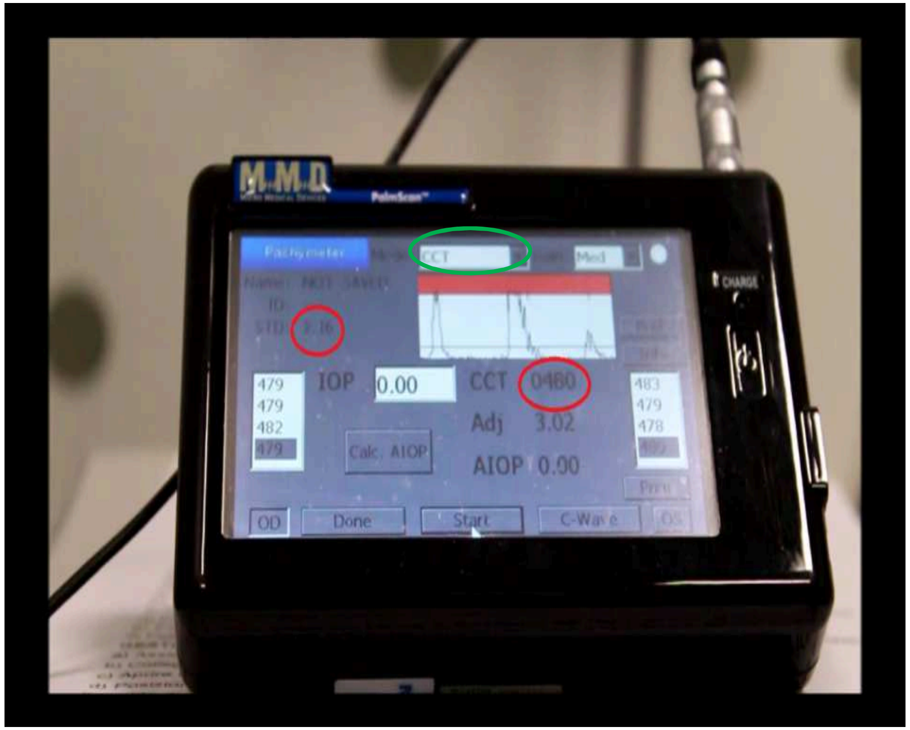
recupero del cap
(con la linea di repere)

misurazione spessore lenticolo
(in pressione)



Pachimetro US in modalità <u>DSAEK</u>

misurazione spessore cap
su capsula di Petri



Pachimetro US in odalità <u>CCT</u>

posizionamento del cap sul lenticolo (facilitato dalla linea di repere)

<u>delicata</u> rimozione della campana
(a camera artificiale ribaltata)

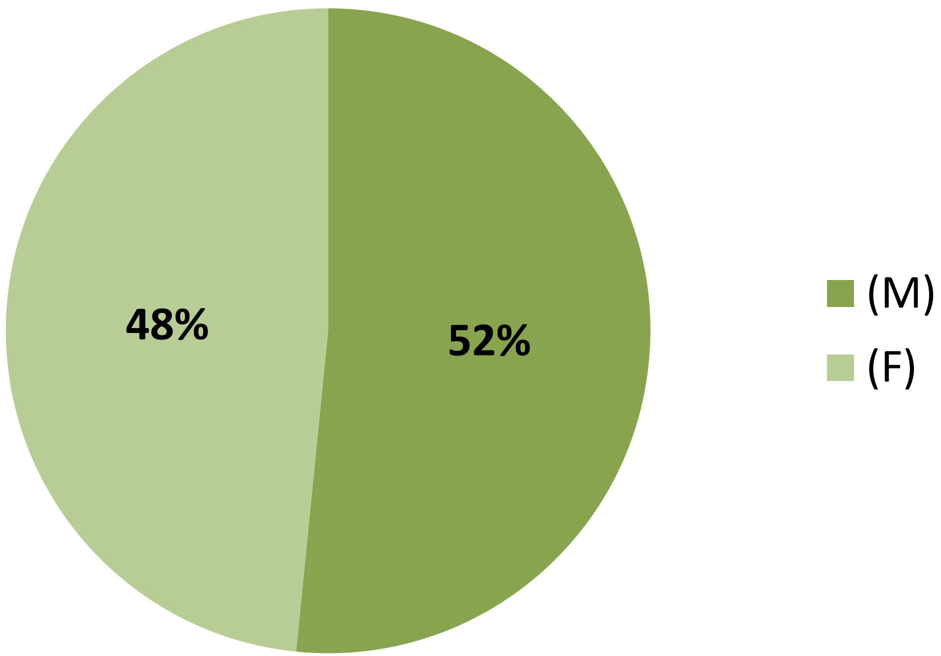
<u>delicata</u> rimozione del lenticolo

posizionamento del lenticolo
nel mezzo di trasporto

si chiude e si sigilla
il flacone

Numerosità Campionaria Stratificata

sesso	n°	età media	sd	min	max
(M)	49	68,9	12,1	41	95
(F)	46	73,5	13,1	47	93
totale	95	**71,2**	12,6	41	95



Risultati: valori medi

lama	n°	Pachi 1 >	Pachi 2	Taglio <	Cap	Lamella
300 µm	16	556,7	482,7	339,1	355,7	143,7
350 µm	39	587,7	514,3	402,1	419,1	112,2
400 µm	23	637,1	573,3	470,2	479,9	103,1
450 µm	17	730,7	640,4	535,2	537,5	105,1

Risultati: valori medi

lama	n°	Pachi 1	Pachi 2	Taglio	Cap	Lamella
300 µm	16	556,7	482,7	339,1	355,7	**143,7**
350 µm	39	587,7	514,3	402,1	419,1	**112,2**
400 µm	23	637,1	573,3	470,2	479,9	**103,1**
450 µm	17	730,7	640,4	535,2	537,5	**105,1**

Risultati: lama Vs taglio

lama	n°	taglio medio	SD	CV	min	max	LI 95% IC	LS 95% IC	media %
300 µm	16	339,1	25,2	0,07	307	386	326,6	351,3	13,1
350 µm	39	402,1	33,4	0,08	316	459	391,6	412,6	14,9
400 µm	23	470,2	32,3	0,06	400	549	457,1	483,5	17,6
450 µm	17	535,2	37,3	0,06	495	602	517,5	553,1	19,1

Risultati: lama Vs taglio

lama	n°	taglio medio	SD	CV	min	max	LI 95% IC	LS 95% IC	media %
300 µm	16	**339,1** 40 µm	25,2	0,07	307	386	326,6	351,3	13,1
350 µm	39	**402,1** 50 µm	33,4	0,08	316	459	391,6	412,6	14,9
400 µm	23	**470,2** 70 µm	32,3	0,06	400	549	457,1	483,5	17,6
450 µm	17	**535,2** 80 µm	37,3	0,06	495	602	517,5	553,1	19,1

Risultati: lama Vs taglio

lama	n°	taglio medio	SD	CV	min	max	LI 95% IC	LS 95% IC	media %
300 µm	16	339,1	25,2	0,07 7 %	307	386	326,6	351,3	13,1
350 µm	39	402,1	33,4	0,08 8 %	316	459	391,6 ≈ 25 µm	412,6	14,9
400 µm	23	470,2	32,3	0,06 6 %	400	549	457,1	483,5	17,6
450 µm	17	535,2	37,3	0,06 6 %	495	602	517,5	553,1	19,1

Risultati: lama Vs taglio

lama	n°	taglio medio	SD	CV	min	max	LI 95% IC	LS 95% IC	media %
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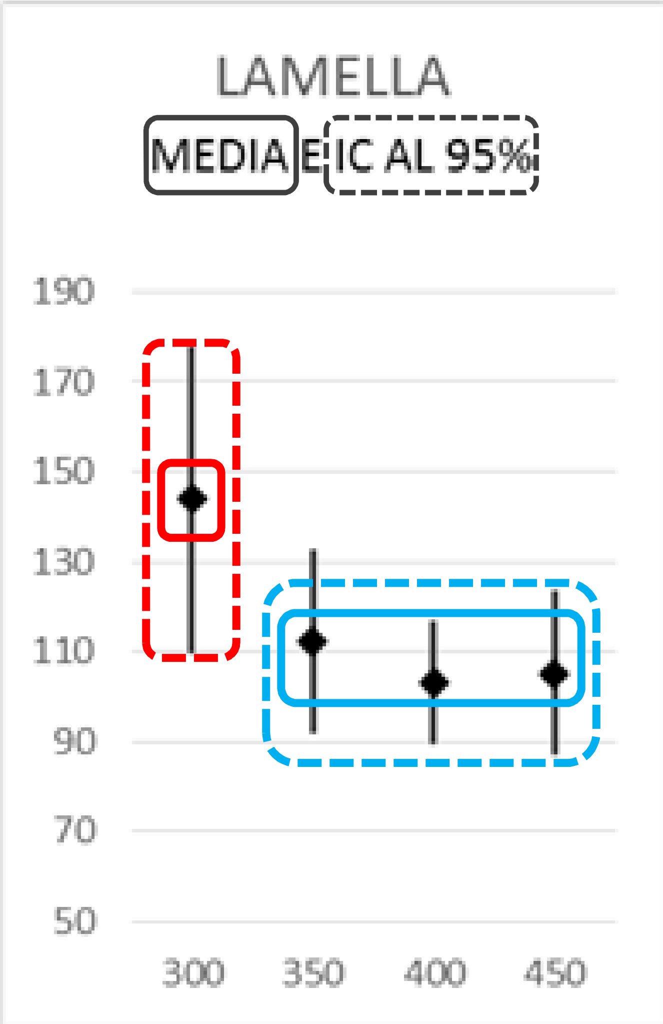
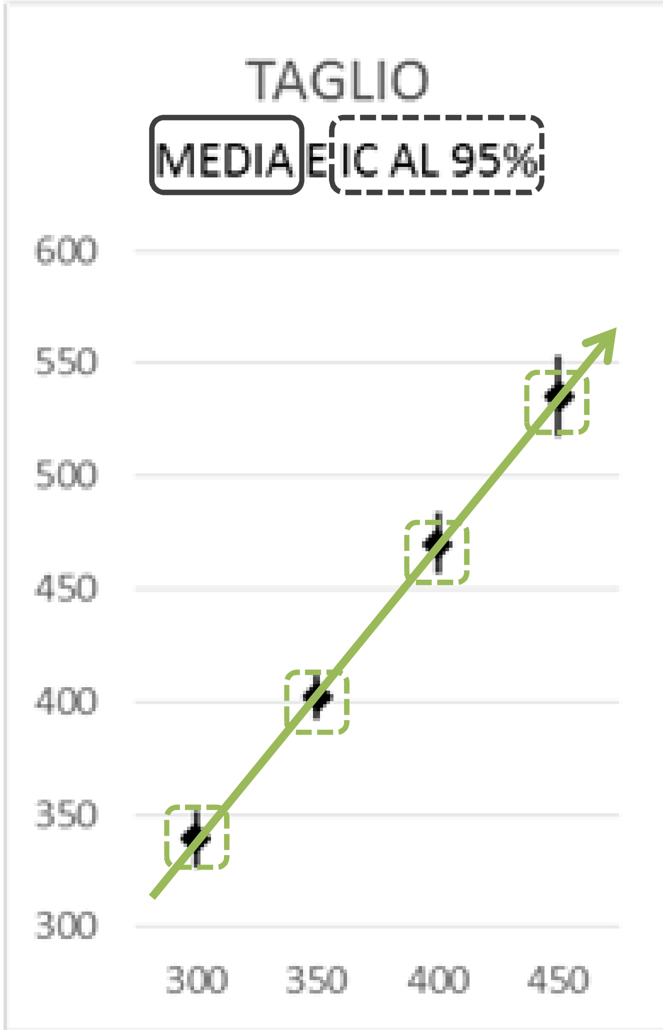
350 µm	39	402,1	33,4	0,08	316	459	391,6	412,6	**14,9**
400 µm	23	470,2	32,3	0,06	400	549	457,1	483,5	**17,6**
450 µm	17	535,2	37,3	0,06	495	602	517,5	553,1	**19,1**

Grafici (I)

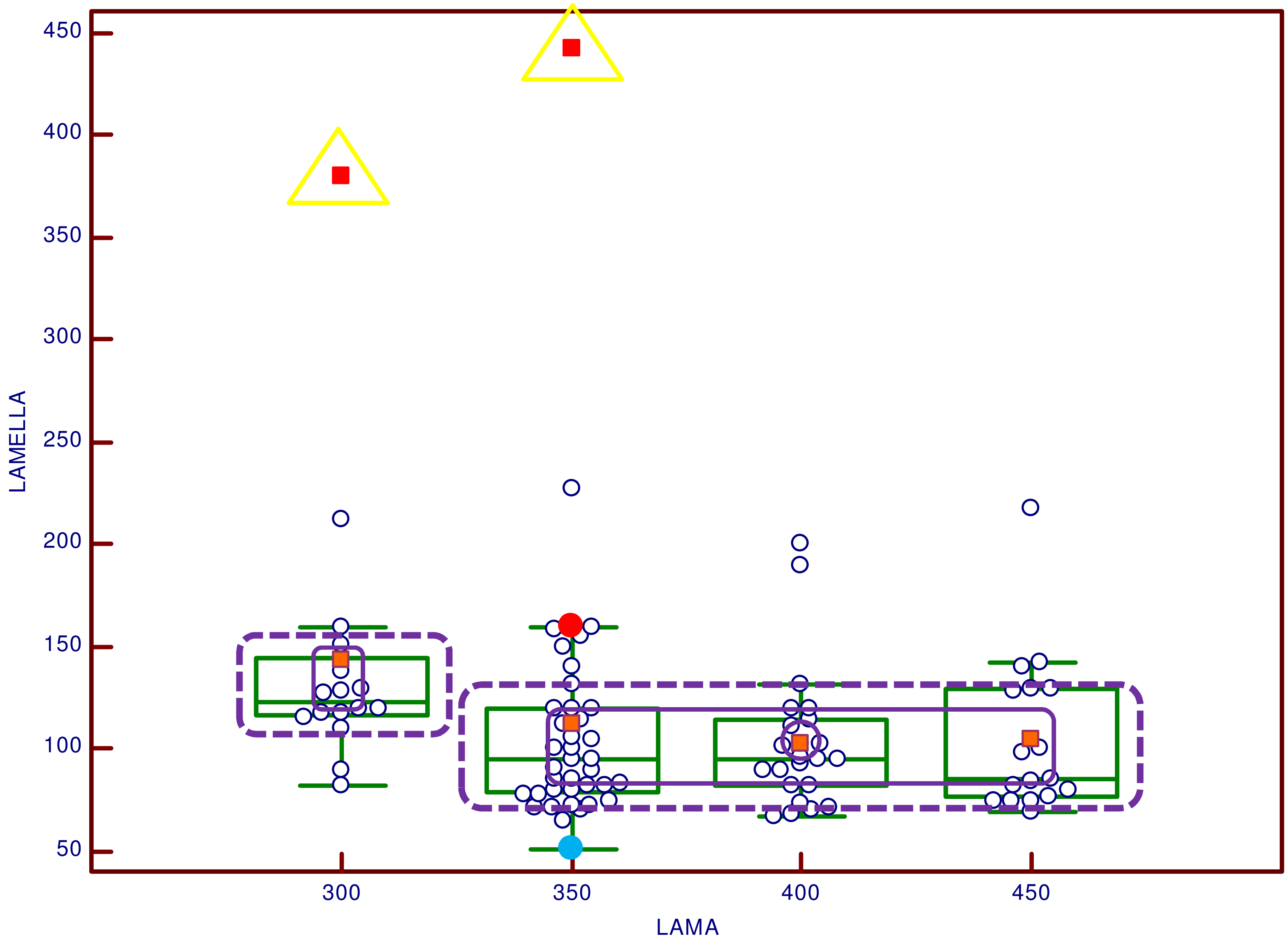


spessore ≈ 110 µm

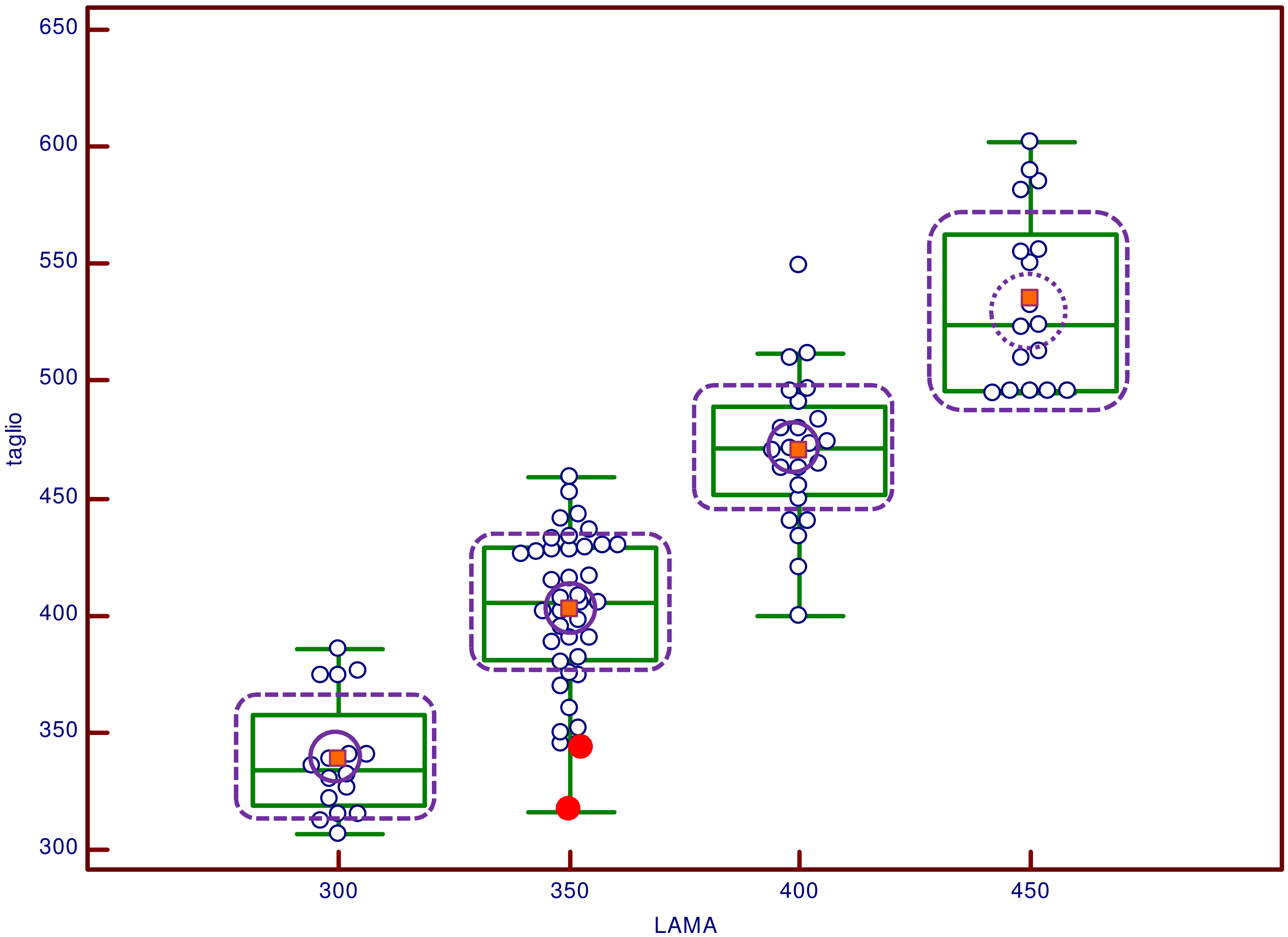


scarto < + 20%

Grafici (II)



Grafici (II)



Sesso & Età: quale ruolo?

NESSUNA CORRELAZIONE CON QUALSIASI VARIABILE CONSIDERATA!

In corso di validazione: ulteriori devices

- AAC PM
- AS OCT

miglioramento della prevedibilità del taglio delle lamelle!!!


GRAZIE per l'ATTENZIONE!