

Recent Trends in Refractive Surgery

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gruppo
refrattivo
italiano





A dirt road splits into two paths leading towards a bright sun on a horizon with clouds.

REFRACTIVE SURGERY

SAFETY

STANDARDIZATION

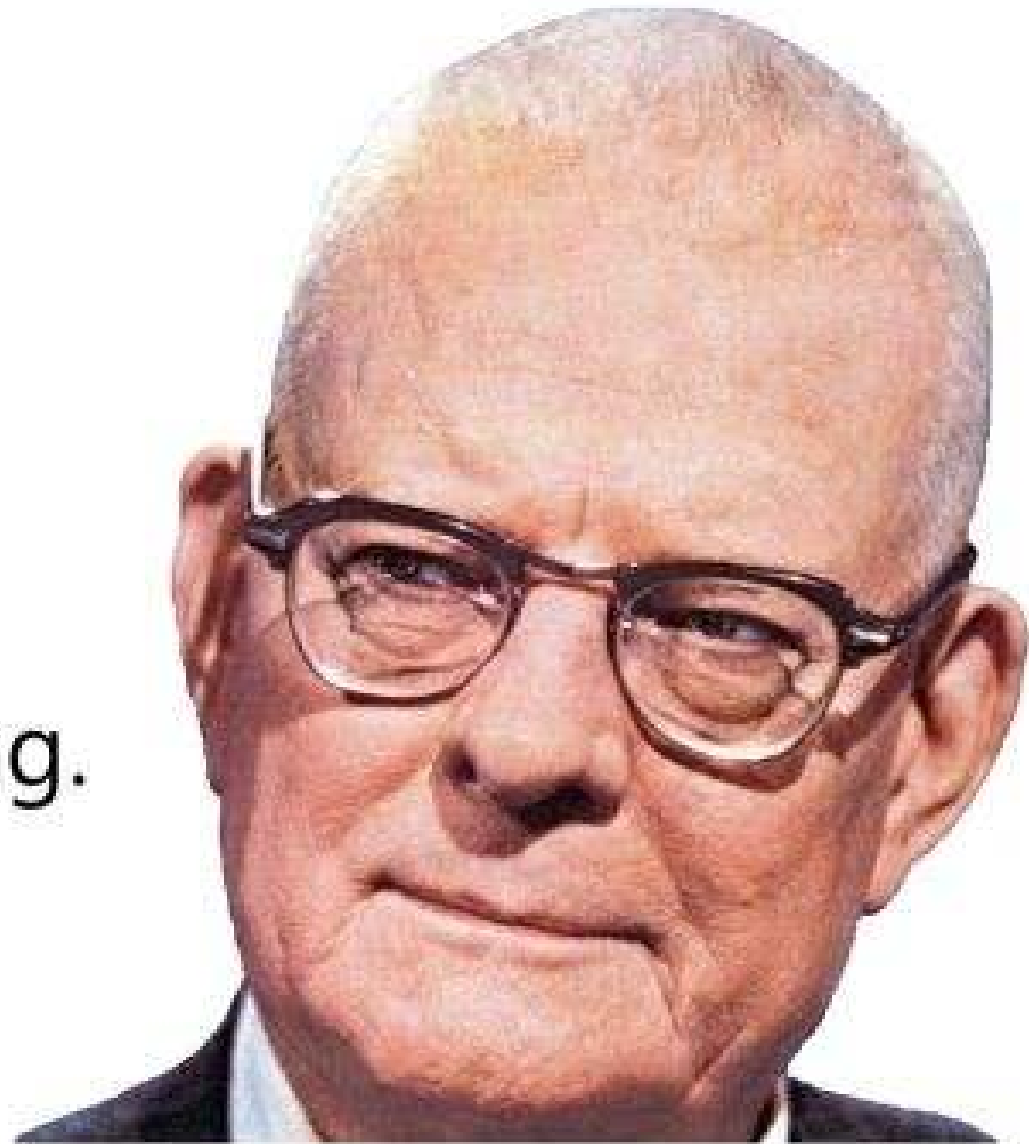


If you think of standardization as the best that you know today, but which is to be improved tomorrow; you get somewhere.

— *Henry Ford* —

If you can't
describe what
you are doing
as a process,
you don't know
what you're doing.

William Edwards Deming



S



*"No wise person
his talent and
his check"*



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THE SUNDAY TIMES No. 1 BESTSELLER

MATTHEW

"...we have an allergic attitude to failure. We try to avoid it, cover it up and airbrush it from our lives... Brailsford, Dufo and Vowles see weaknesses with a different set of eyes. Every error, every flaw, every failure, however small, is a marginal gain in disguise. This information is not a threat but an opportunity."



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MATTHEW SYED

MARGINAL GAINS AND THE
SECRETS OF HIGH PERFORMANCE

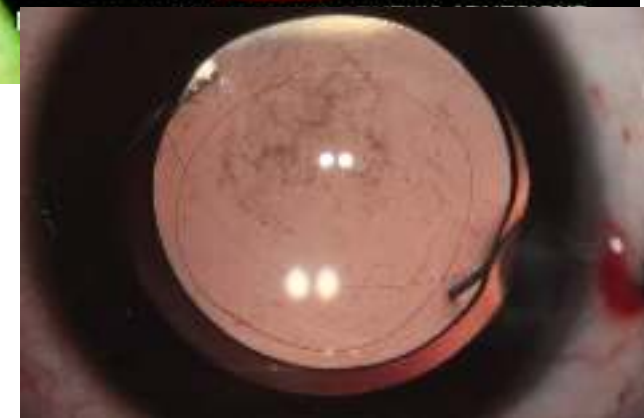
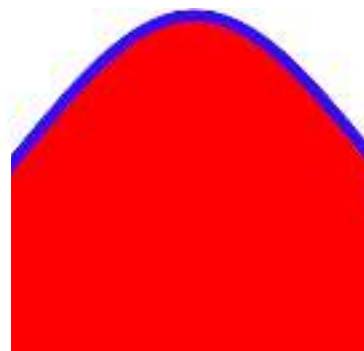
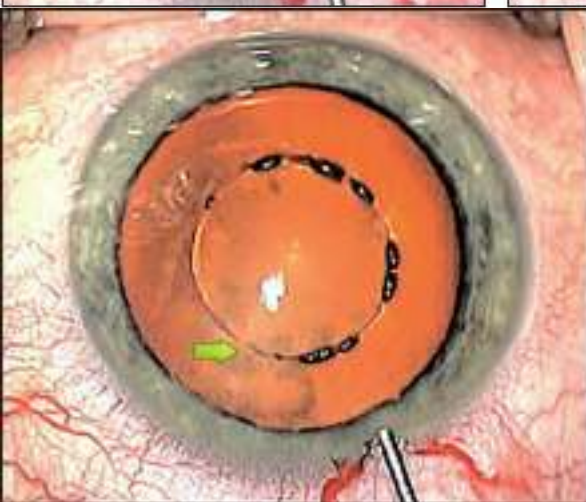
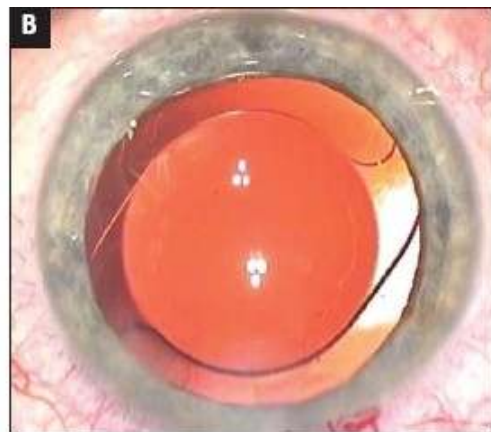


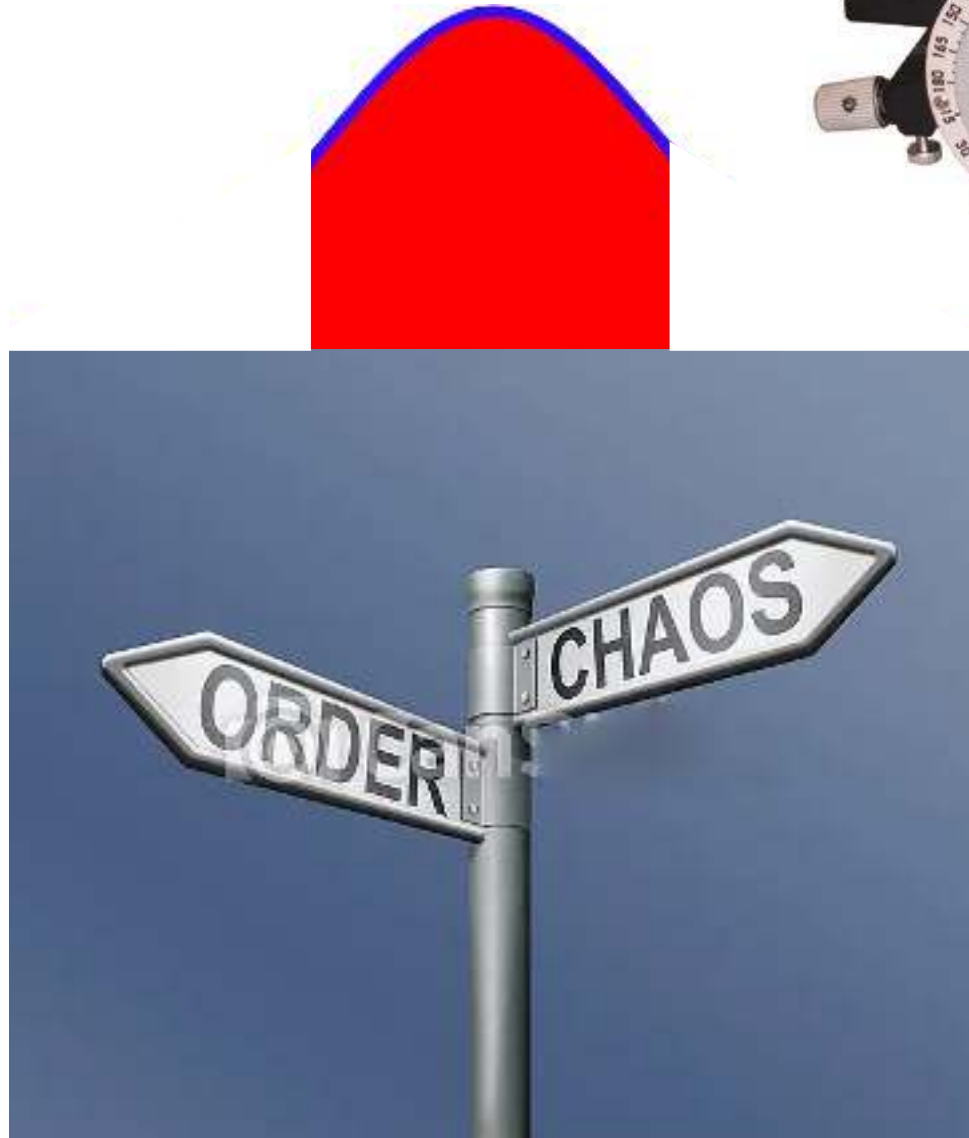
High School

Product

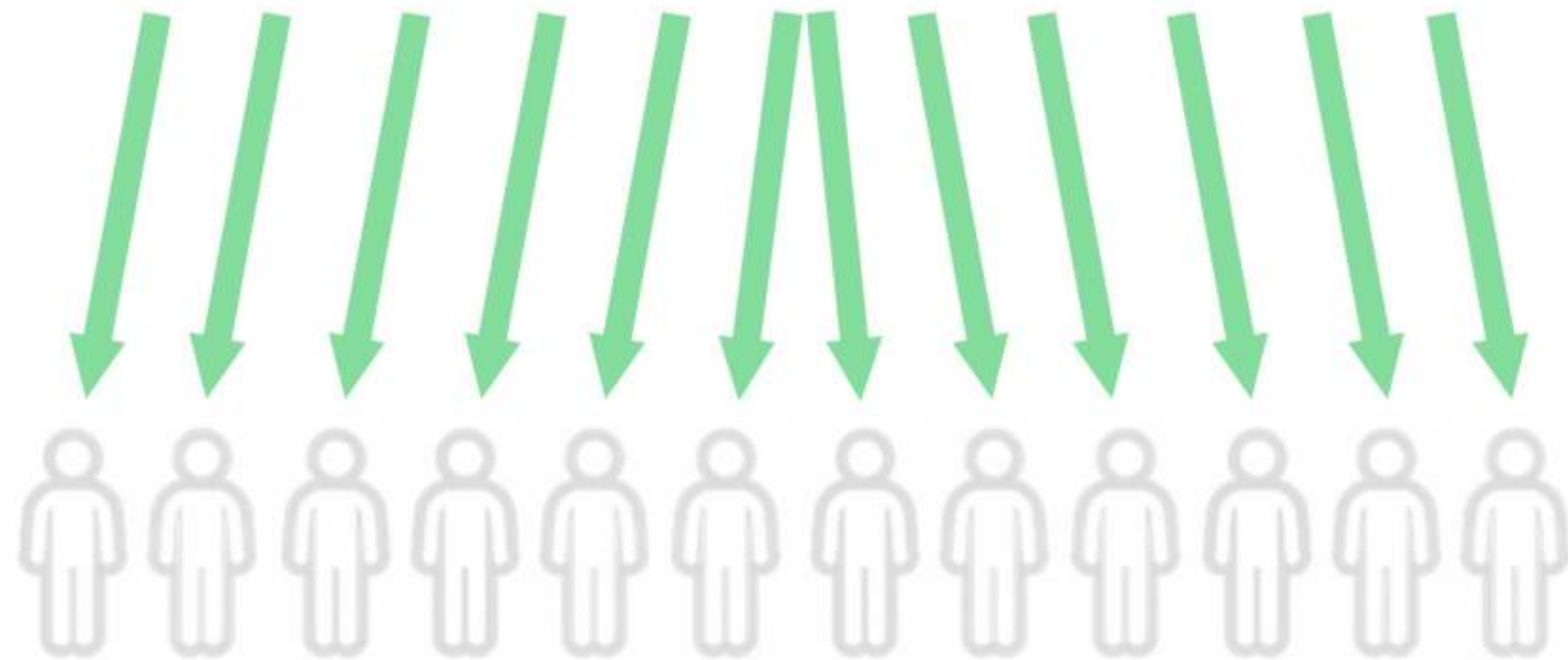
FAST

CUMULATIVE
ADAPTION



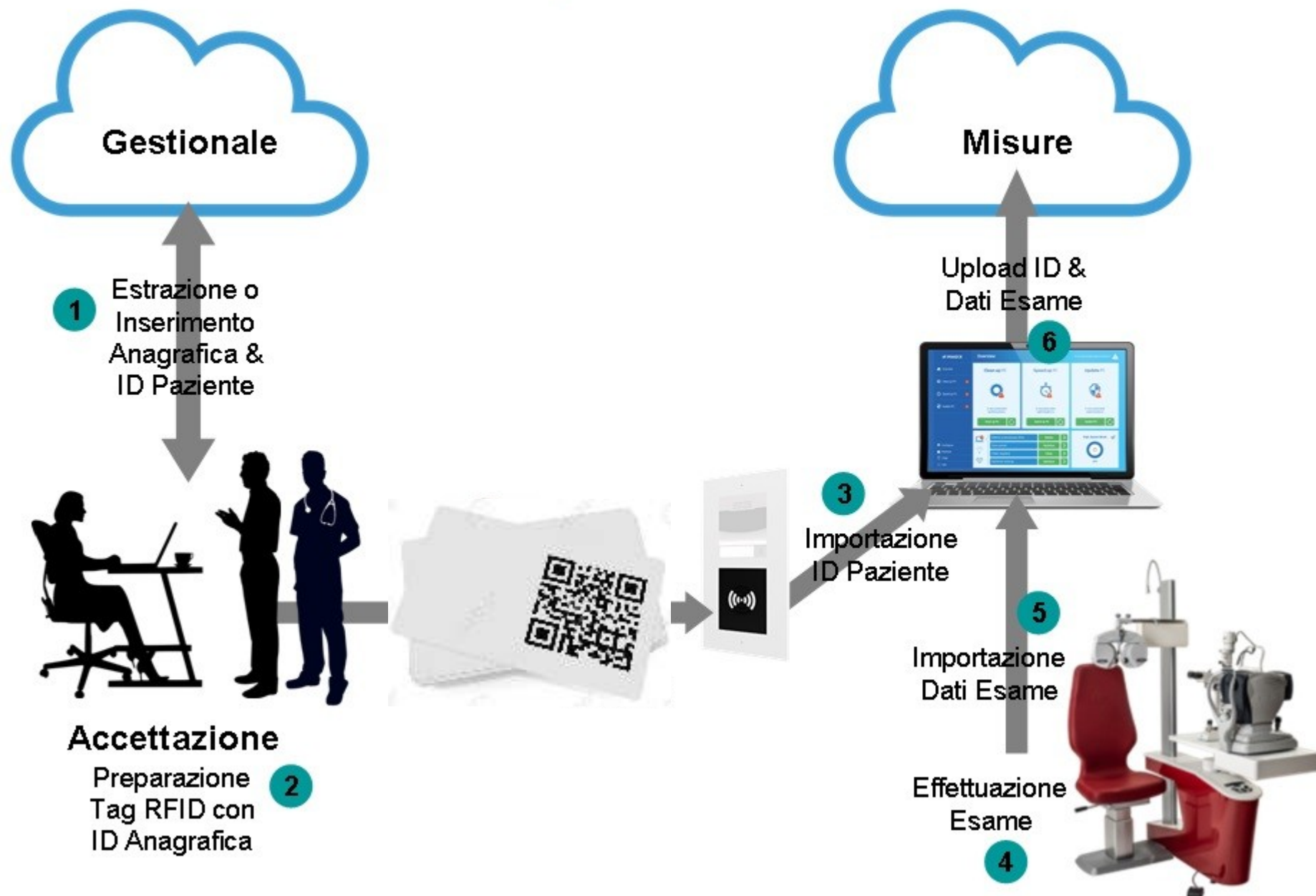


STANDARD TECHNIQUE





Workflow acquisizione dati misure



Chrome

File

Edit

View

History

Bookmarks

People

Tab

Window

Help

- DdasDashboard

WhatTheFont! - MyFonts

←

→

↻

Not Secure

odas.westeurope.cloudapp.azure.com:8081/Dashboard?patientDaid=2296&dateString=2021-01-04

☆

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ODAS

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👤

Andrea

Dashboard

Pazienti

Sign Out

Lazzarini Roberta

Età: 55

PATIENT

04-01-2021

EXAM

Seglia critica

Seglia base

🕒

Occhio Destro

👁

Sph: +1.25

Cyl: -1

Axis: 90

NI-BUT: 5.5

Ep Thk Cnt: 49.24

Ep Thk Avg: 49.265

K Avg: 44.692

SAD D: 0.27

K1: 44.691

K2: 44.614

Axis (S K1): 88

Axis (S K2): 8

RM: 1.8

RM: 0.11

K: 1.88

CR1: 1.01

IRK: 4.4

PH: 0.008

RMS: 0.427

Asph. Q: -1.31

HFWD: 11.11

Pupil X Dec: -0.156

Z 40: 0.006

Trifo: 0.006

OCT: 879.214

Pupil Y Dec: 0.318

Corne: 0.19

ACD: 2.846

Scotopic Pupil: 5.92

OSI: 1.935

Axial Length: 23.194

Surgical Score:

LASK: 5

PRESBYOND: 5

SMILE: 0

PRK: 0

ICL: 5

ICL: 100

Topo guided: 0

Occhio Sinistro

👁

Sph: +1.25

Cyl: -0.75

Axis: 78

NI-BUT: 5.5

Ep Thk Cnt: 47.937

Ep Thk Avg: 50.721

K Avg: 44.945

BAD D: 1.32

K1: 44.792

K2: 44.898

Axis (S K1): 74

Axis (S K2): 104

RM: 1.8

RM: 0.19

K: 1.86

CR1: 1

IRK: 1.3

PH: 0.016

RMS: 0.477

Asph. Q: -0.33

HFWD: 11.927

Pupil X Dec: 0.043

Z 40: 0.005

Trifo: 0.005

OCT: 878.4

Pupil Y Dec: 0.295

Corne: 0.16

ACD: 2.83

Scotopic Pupil: 6.04

OSI: 1.654

Axial Length: 23.32

Surgical Score:

LASK: 5

PRESBYOND: 5

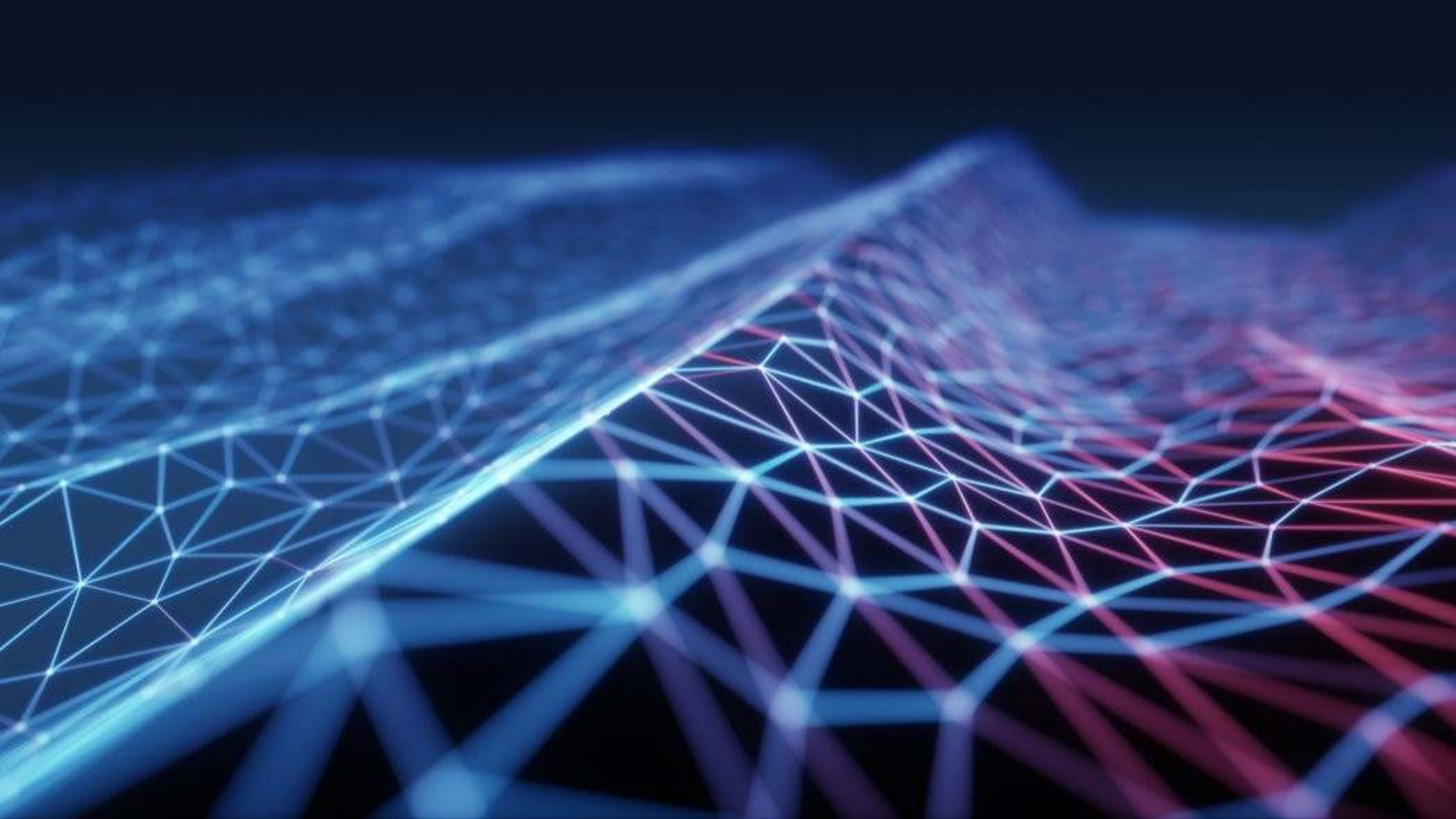
SMILE: 0

PRK: 0

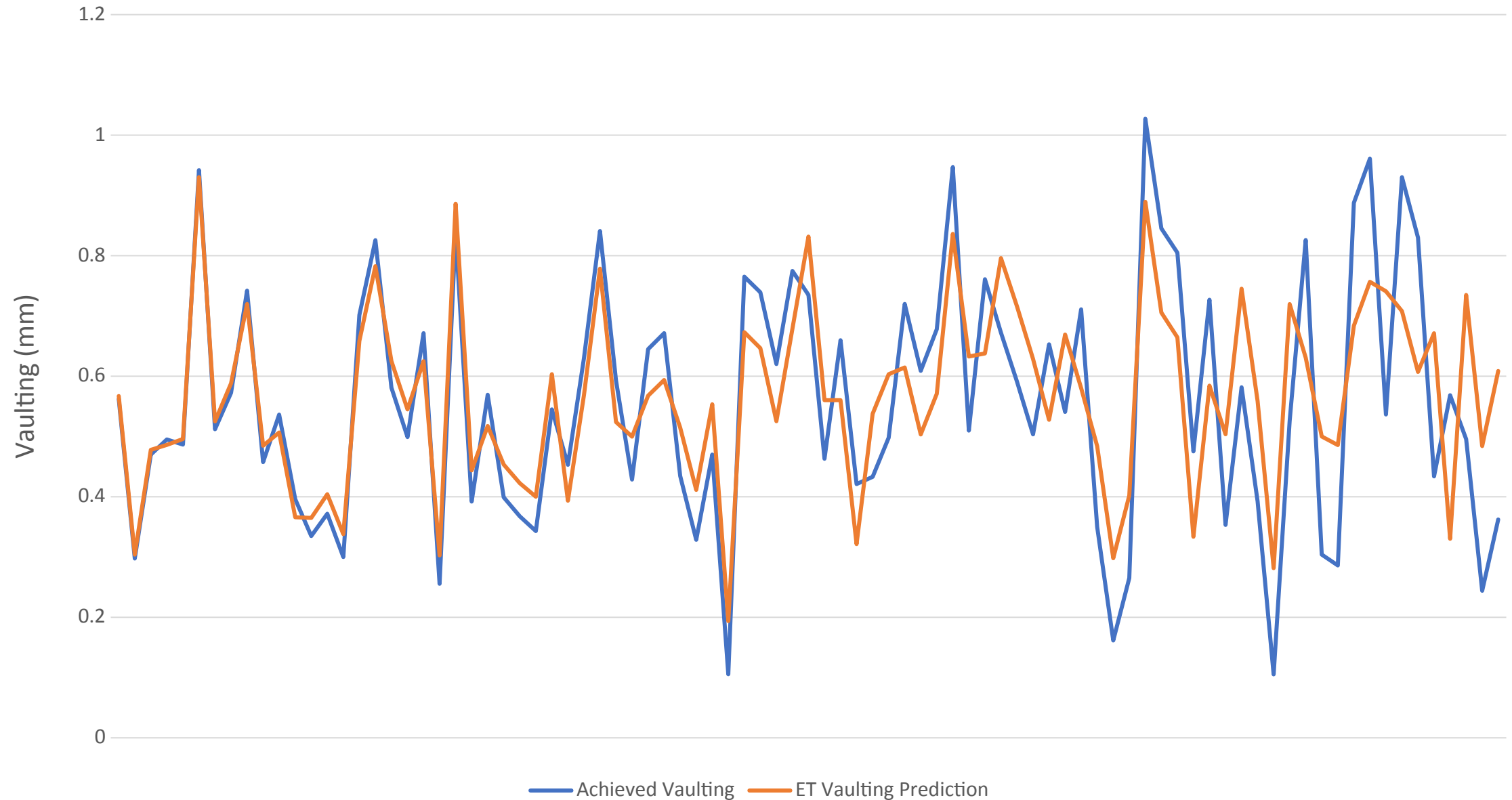
ICL: 5

ICL: 100

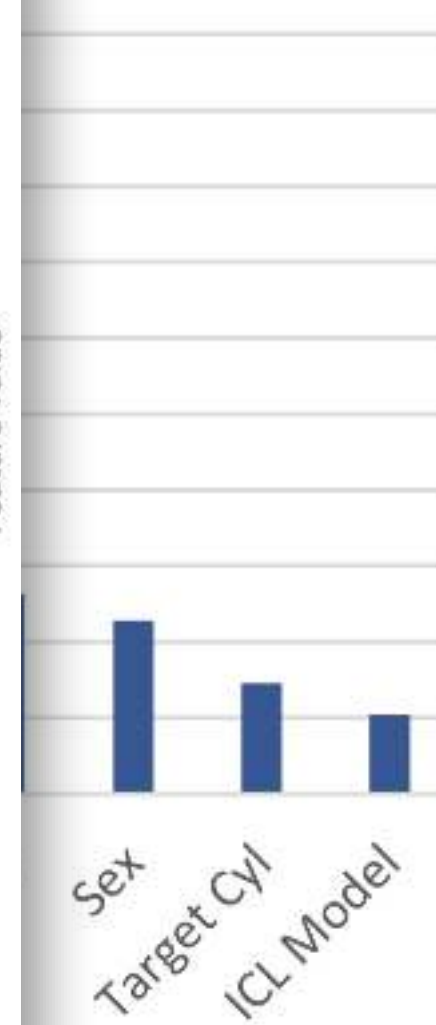
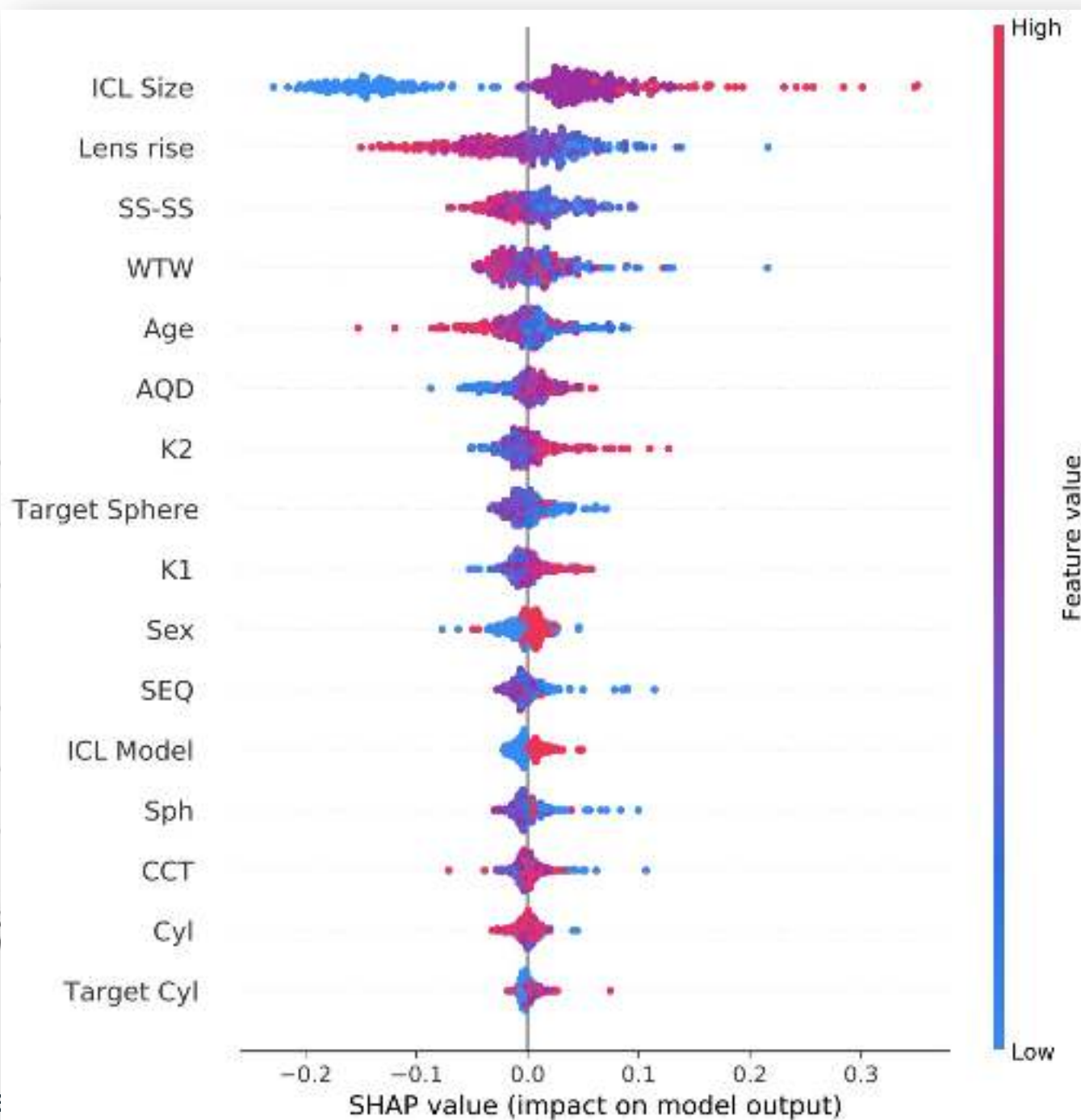
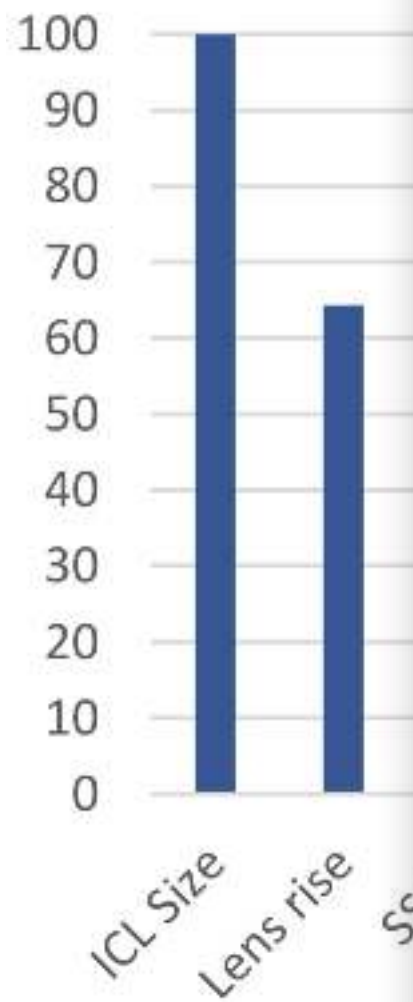
Topo guided: 5



High accuracy across the entire range of vaulting values



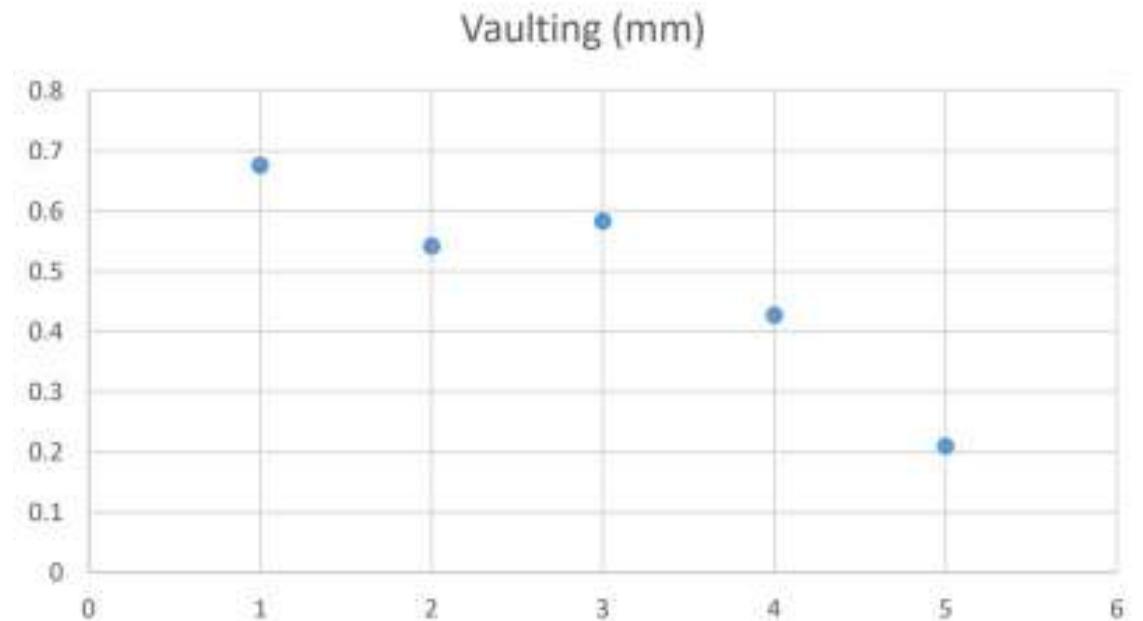
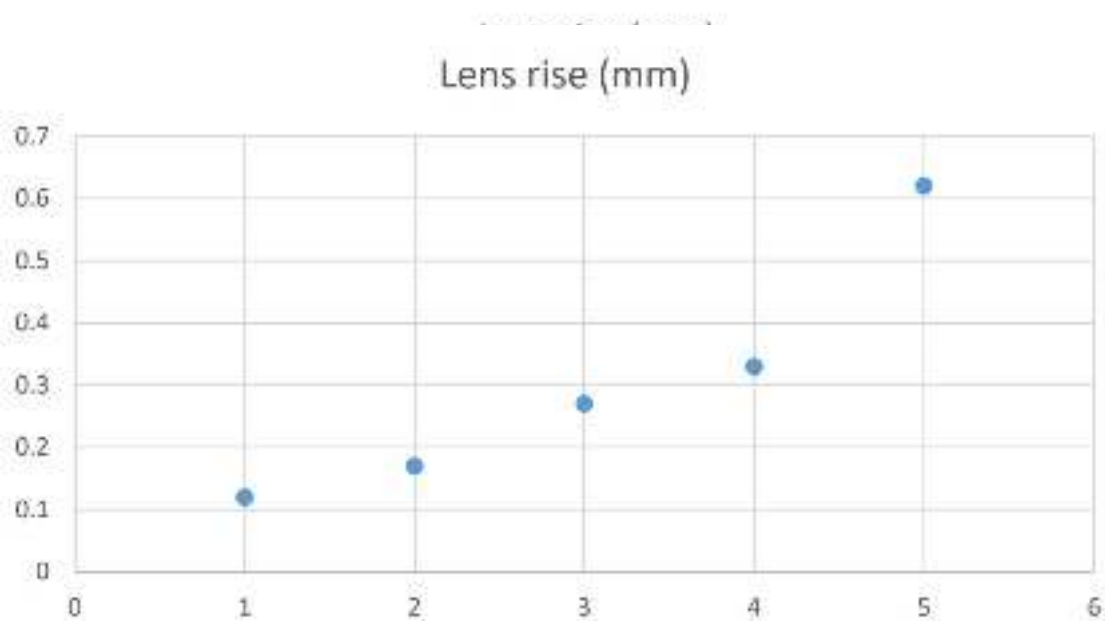
A. Russo, O. Filini, G. Savini et al. Predictability of the Vault after Implantable Collamer Lens Implantation Using OCT and Artificial Intelligence in Caucasian Eyes; *Journal of Cataract & Refractive Surgery* ():10.1097/j.jcrs.0000000000001182



Surgery Outcomes Prediction

Multidimensional analysis allows to obtain a **measure of similarity** between patients, taking into consideration multiple variables at the same time.

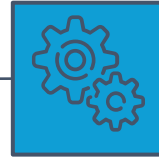
By analyzing aggregate data from various sources, **patterns and trends can be identified.**



Input



ML Model



Predict prob.

Output

85%

LASIK



9%

LASIK Presbyond

4%

SMILE

2%

ICL

 **Occhio Sinistro**

Sph: **-1.5**

Cyl: **-0.5**

Axis: **180**

NI-DUT: **6.7**

Ep Thk Cnt: **58,662**

K1: **44.049**

Axis (d1 K1): **177**

ISV: **19**

CK: **1.01**

BAD-D: **0.76**

Ep Thk Avg: **56,324**

K2: **44.883**

Axis (d1 K2): **87**

NA: **0.06**

IHA: **4.8**

K Avg: **44.462**

K: **1.03**

IHD: **0.005**

RMS: **0.23**

Z 4 0 (MS39): **0.153**

HVID: **12.11**

Pupil X Dec: **0.17**

Z 4 0 (Qwrt):

Asph. Q: **-0.53**

CCT: **554.512**

Pupil Y Dec: **0.045**

Coma: **0.053**

Trifoil: **0.127**

ACD: **3.298**

Scotopic Pupil: **6.503**

The surgeon can select the input features.

The ML model learns how to identify clinical conditions in which a certain type of surgery was effective.

LASIK

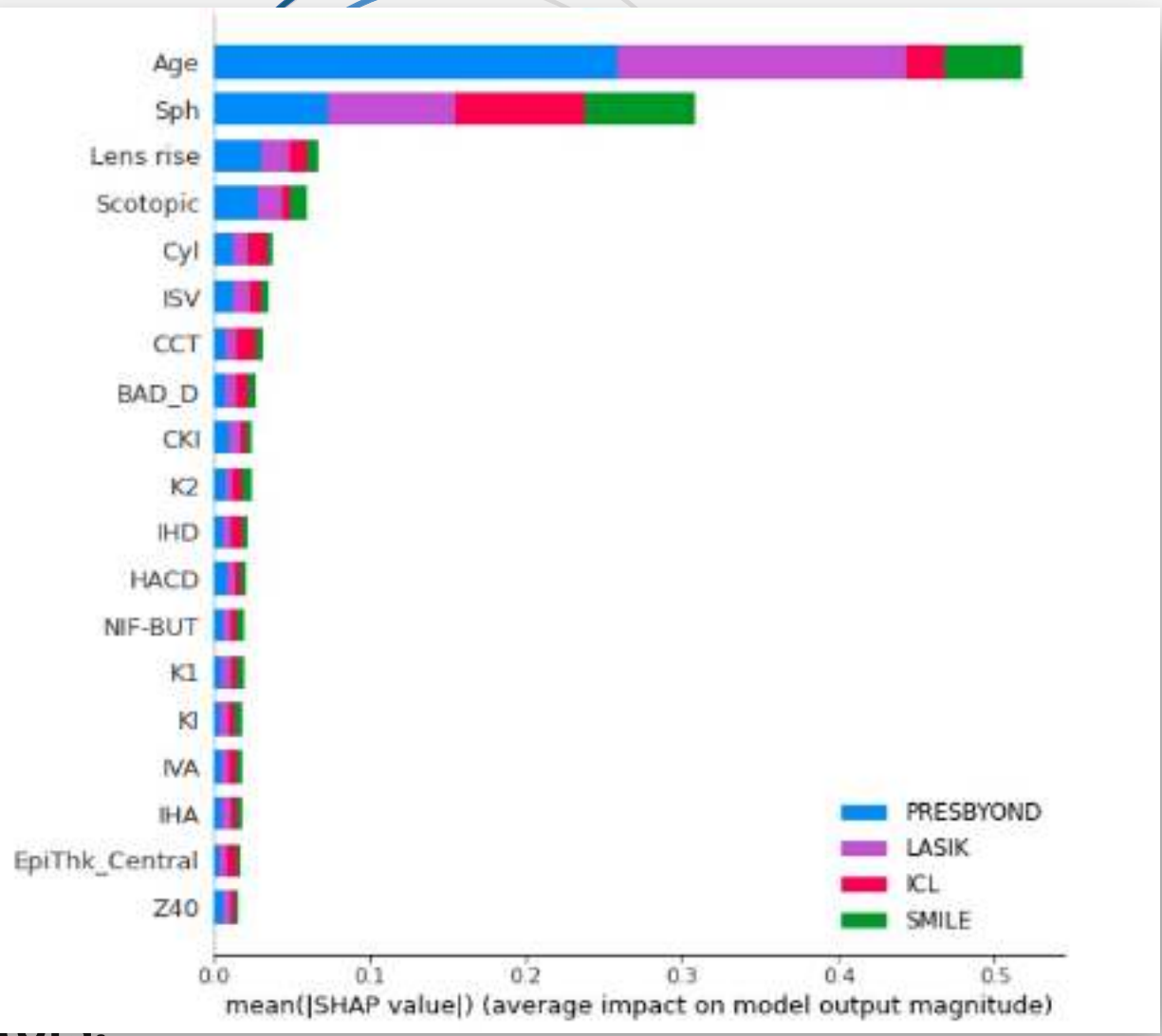
LASIK Presbyo

SMILE

ICL

ML classification
type of surgery

ML algorithm
experienced doctors.



89% of
Accuracy



Addressing Key Challenges in Machine Learning Integration: Interpretability of ML Results

SHAP force plot gives us the explainability of a single model prediction. In this plot, we can see how features contributed to the model's prediction for a specific observation

LASIK: Predict prob. = 85%

Why?

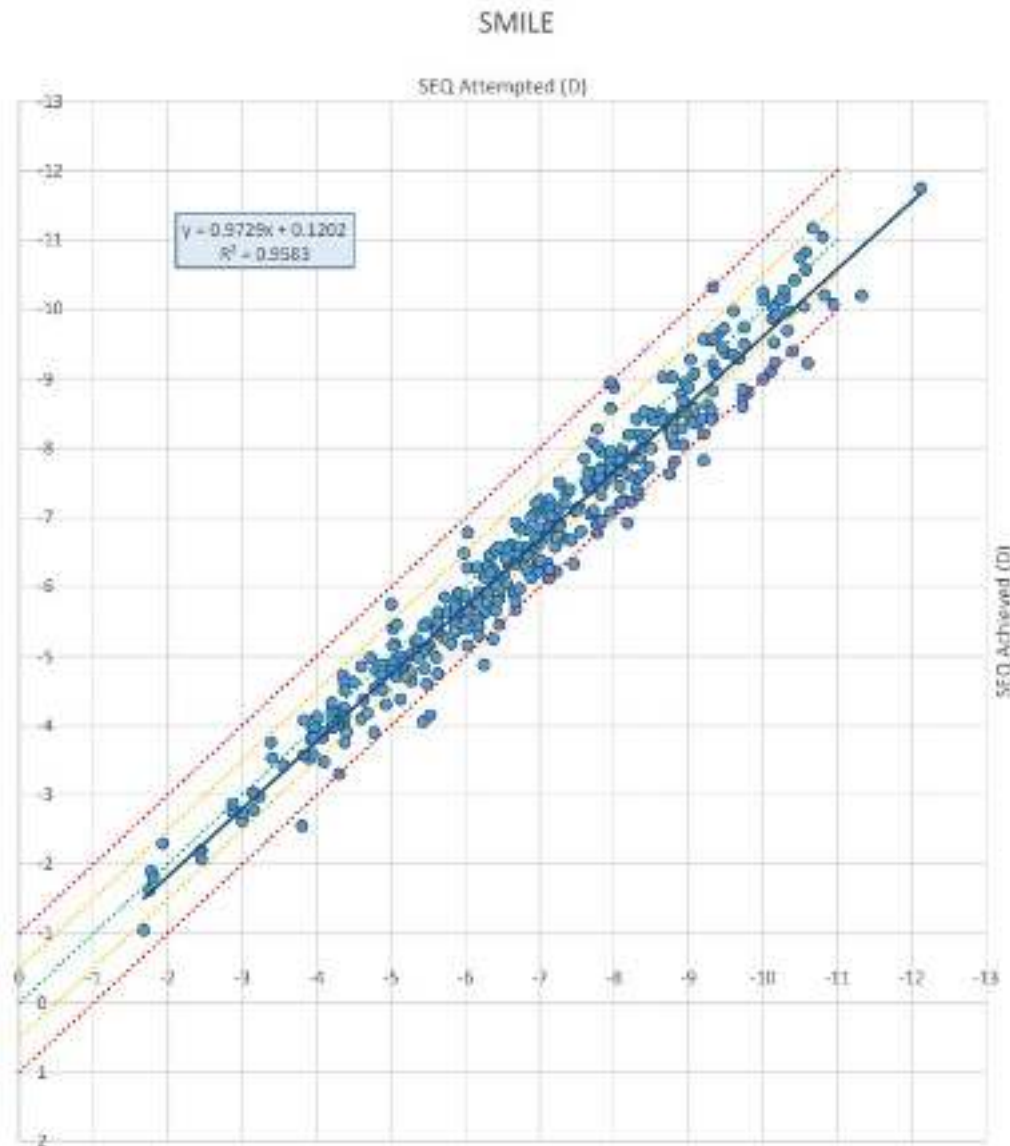


ICL: Predict prob. = 2%

Why?



Automated Nomogram Development



- Optimize results, saving enhancements and costs
- Remove laser component
- Quick identification among each point in the scatter plot and the patient's corresponding patient
- Easy elimination of outliers
- Immediate comparison of the outcome of a specific surgery with the average result of the same category (i.e. type of surgery and type of correction)



Random



Machine
Learning



Standardization