Corneal Biomechanical Characteristics after Penetrating Keratoplasty by Femtosecond Laser

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The authors have no financial interests in the subject matter of this study.

Background(1)

- Wound dehiscence by blunt trauma occurs in 1% of patients after trephine blade penetrating keratoplasty (t-PKP).

Agrawal V, et al. Cornea 14(601-3),1995

- Reduced biomechanical parameters are found in eyes that have undergone t-PKP compared with normal eyes.

Laiquzzaman M, et al. Clinical and Experimental Ophthalmol.38(8):758-63 2010

Background(2)

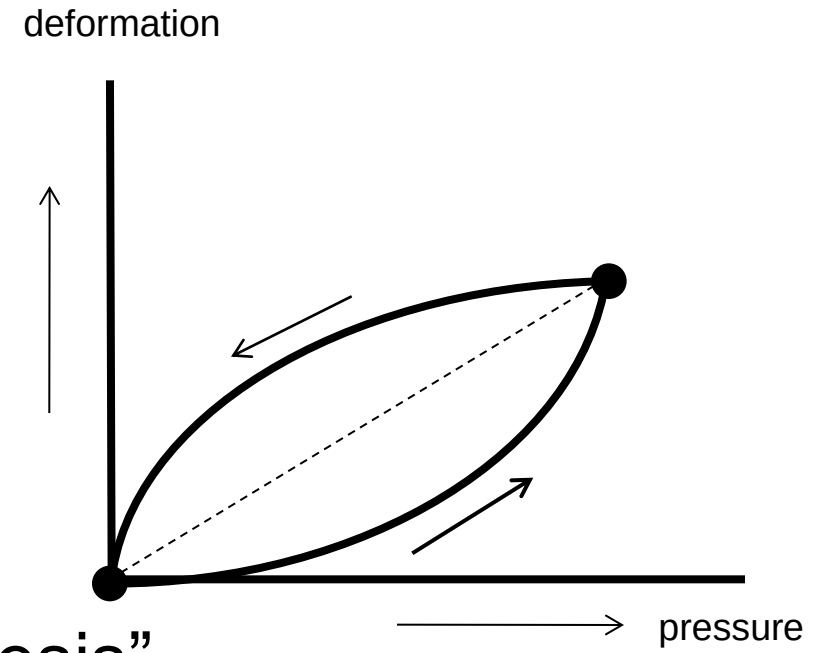
- Corneal strength post zig-zag penetrating keratoplasty (z-PKP) by use of a femtosecond laser is considered to be more close to that of the normal eye and eyes post Descemet's stripping automated endothelial keratoplasty (DSAEK) than those post t-PKP.

  Wakimasu K, et al. ASCRS 2011, 2012

- In this report, the number of z-PKP cases was increased and follow-up examinations, including a new parameter, were performed.

Corneal Biomechanics

- Objects are deformed by pressurization, and attempt to return to their original shape through decompression.
- Viscoelastic bodies have a different deformation process between pressurization and decompression; i.e.,“hysteresis”.



Purpose

- To evaluate corneal biomechanics after z-PKP, t-PKP, DSAEK, and that in normal eyes.

Patients and Methods

	Eyes	Male	Female	Mean Age	IOP(mmHg)
z-PKP	21	14	7	66±14	14±4
t-PKP	23	13	10	73±11	12±4
DSAEK	19	4	15	72±12	13±4
normal	27	6	21	74±7	14±3

- IntraLase FS-60™ and iFS™ femtosecond lasers (Abbot Medical Optics) were used in 7 eyes and 6 eyes, respectively.
- There was no significant difference in age and IOP between all 4 groups.
- Corneal Hysteresis (CH), Corneal Resistance Factor (CRF), and Keratoconus Match Index (KMI) were measured by use of the Ocular Response Analyzer™ (Reichert) at more than 6 months post keratoplasty, and after removal of the running suture in the t-PKP and z-PKP patients.

Biomechanical Parameters

- Corneal Hysteresis (CH):

Difference in the inward and outward pressure;

viscous damping in the cornea.

- Corneal Resistance Factor (CRF):

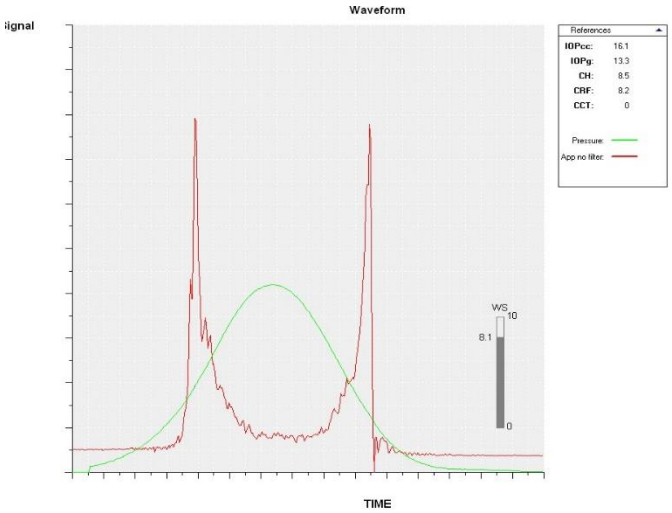
Correlation with central corneal thickness;

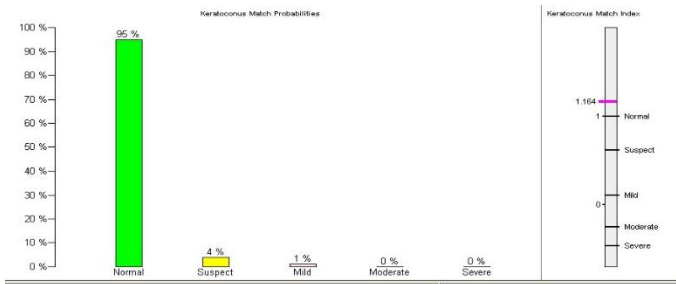
viscous and elastic resistance in the cornea.

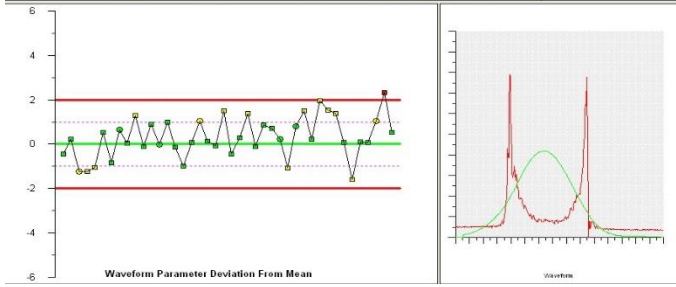
- Keratoconus Match Index (KMI):

Analysis of the waveform parameters in detail;

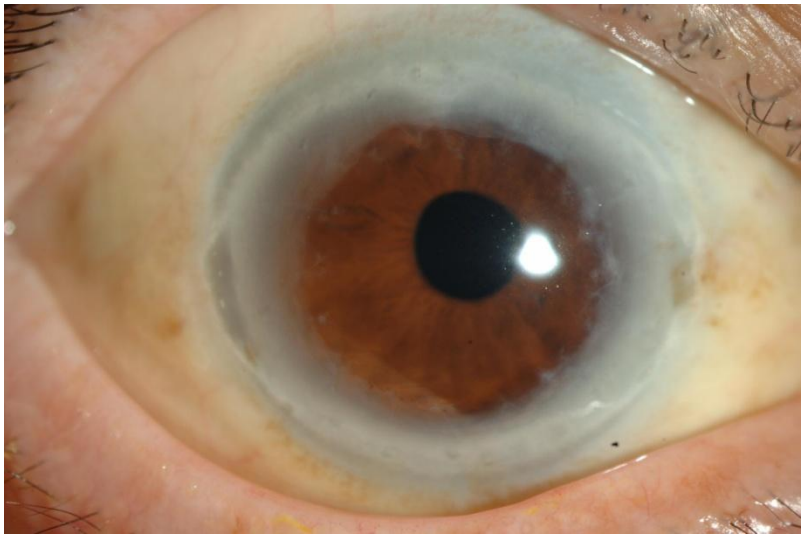
mainly for keratoconus, yet the possibility of more sensitivity than CH/ CRF to other corneal status.



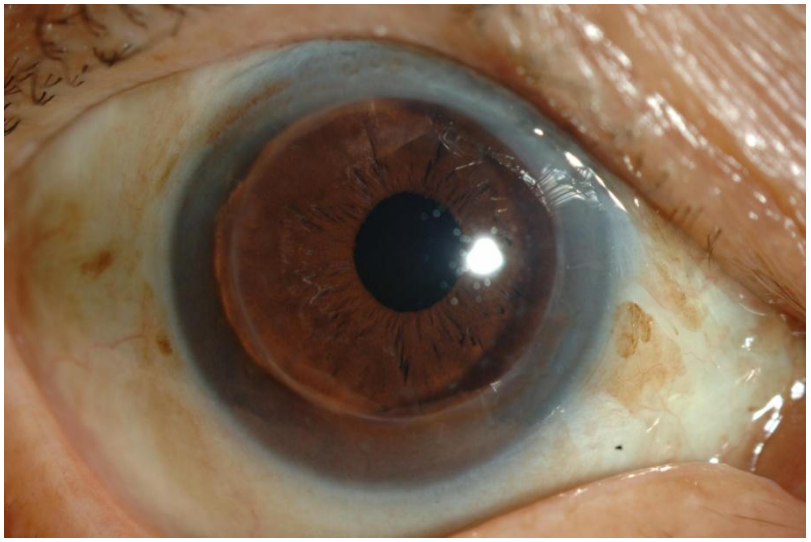




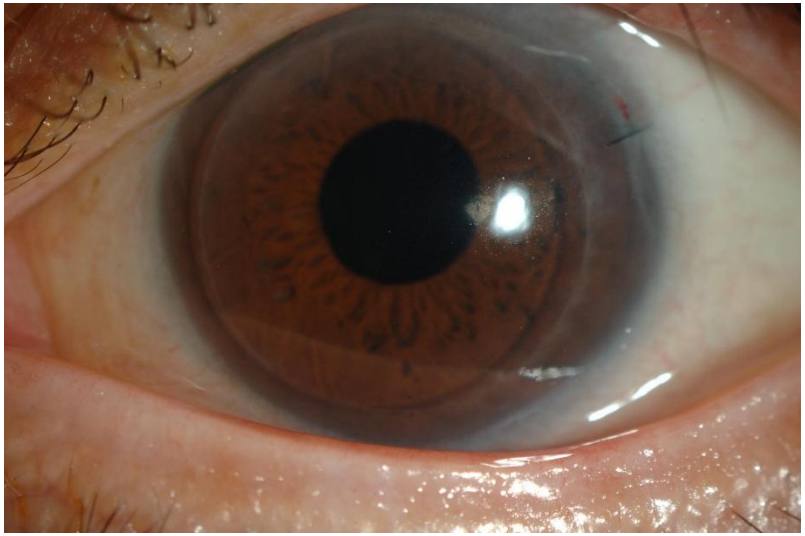
z-PKP



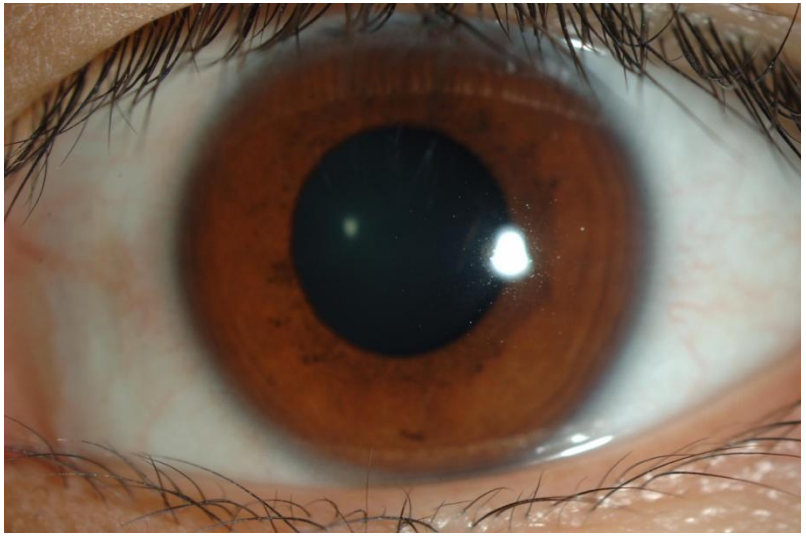
t-PKP

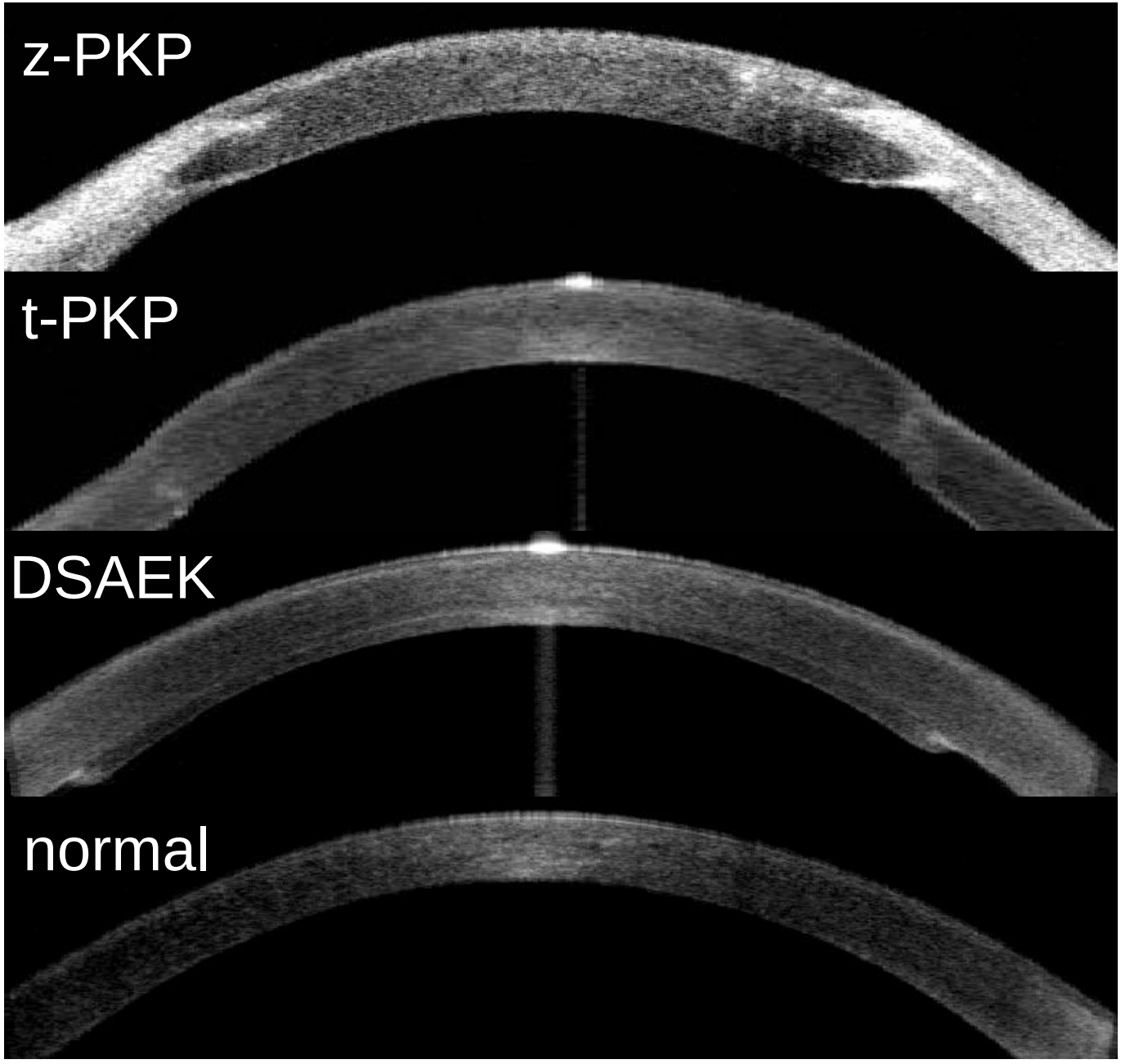


DSAEK



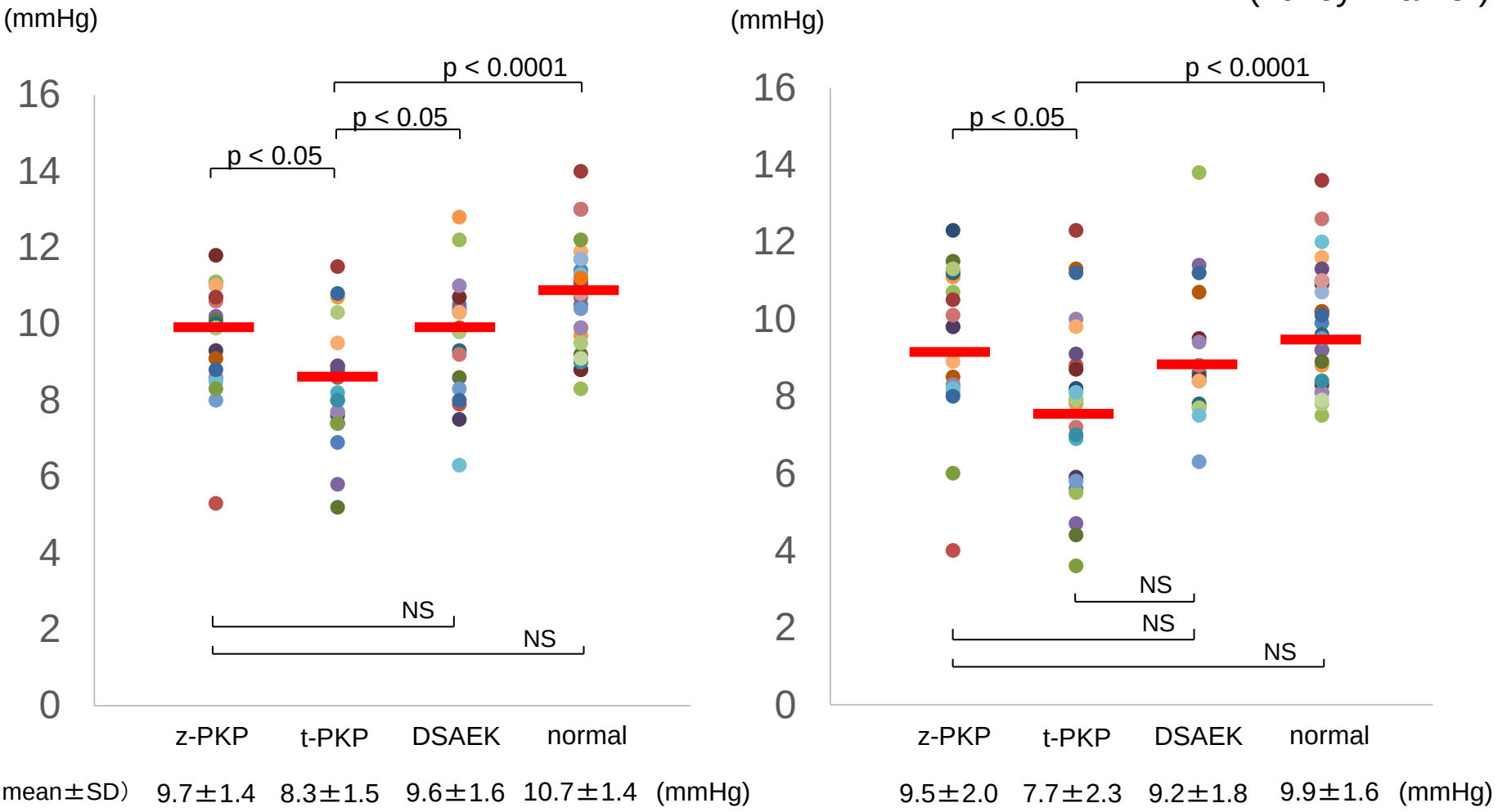
normal




z-PKP
t-PKP
DSAEK
normal

Results 1: CH, CRF

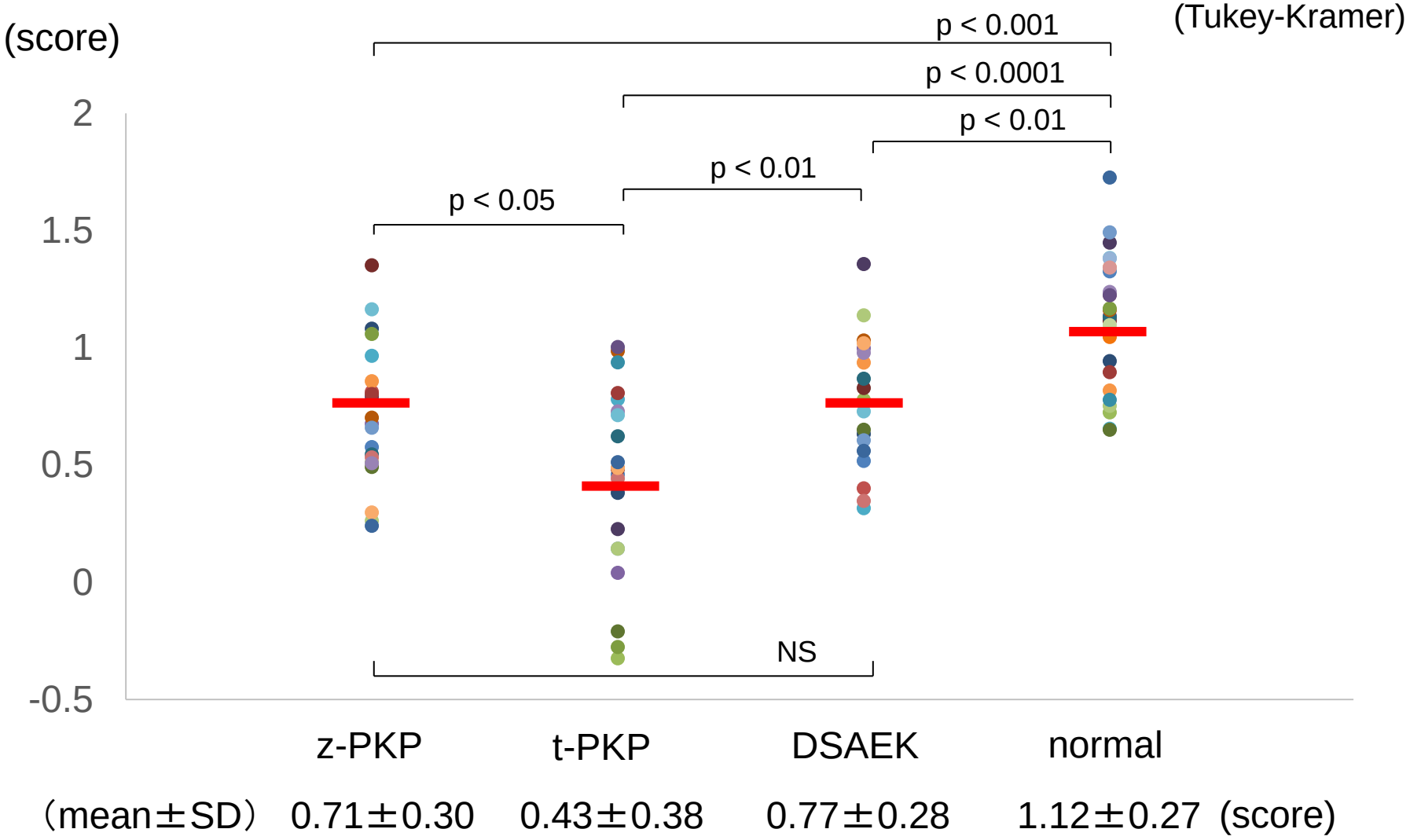
(Tukey-Kramer)



	z-PKP	t-PKP	DSAEK	normal	
(mean±SD)	9.7±1.4	8.3±1.5	9.6±1.6	10.7±1.4	(mmHg)
	9.5±2.0	7.7±2.3	9.2±1.8	9.9±1.6	(mmHg)

- Both CH and CRF of z-PKP were significantly higher than those of t-PKP, and similar to those of DSAEK and normal eyes.

Results 2: KMI



	z-PKP	t-PKP	DSAEK	normal
（mean±SD）	0.71±0.30	0.43±0.38	0.77±0.28	1.12±0.27 (score)

- KMI of z-PKP was significantly higher than that of t-PKP, similar to that of DSAEK, and lower than that of normal eyes.

Discussion

- Corneal strength post z-PKP by femtosecond laser is considered to be higher than that of eyes post t-PKP, and close to that of the normal eyes and of eyes post DSAEK.

- Although further examination is needed, new parameter might be also available to assess the corneal rigidity exactly .