

Refinement of Pre-Set Corneal Epithelial Thickness and Stromal Ablation Rate in One-Step Trans-Epithelial Ablations

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No financial interests.

C-TEN: trans-epithelial PRK

iVis excimer laser suite (iVis Technologies)

- Pre-refinement ablation calculation values
 - Preset epithelial thickness
 - 65 μ over whole ablation zone
 - Assumed ablation rate (average stroma and epithelium)
 - 1.48 μ per “layer”
 - Epithelial ablation rate slightly higher than stromal ablation rate.

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- Consequences of error in assumed values
 - If the assumed epithelial depth is incorrect
 - If 65μ is an overestimate
 - excess stromal ablation will take place
 - If 65μ is an underestimate
 - insufficient stromal ablation
 - Reduction of the optical zone
 - Reduction of aspheric corrections
 - These effects will be
 - exaggerated with lower attempted stromal ablations
 - minimised in higher attempted stromal ablations
 - If the assumed stromal ablation rate is incorrect
 - Over-ablation:
 - Refractive correction not affected since uniform over whole treated area
 - Under-ablation
 - Refractive under-correction

C-TEN: trans-epithelial PRK iVis excimer laser suite (iVis Technologies)

- Purpose of the study:
 - Establish true epithelial thickness
 - Establish a true stromal ablation rate
 - Derive a radial adjustment to allow for the thicker epithelium in the periphery of the ablation zone

Method

- 88 eyes in 64 patients
- 2 centres in Australia
- C-TEN trans-epithelial PRK for any refractive error
- 3 month follow-up
- Comparison of achieved versus attempted ablation depth
 - Precisio tomography pre-op and at 3 months (“surgical”)
 - 3μ tolerance at each measured point to 6 mm zone with test-to-test mapping

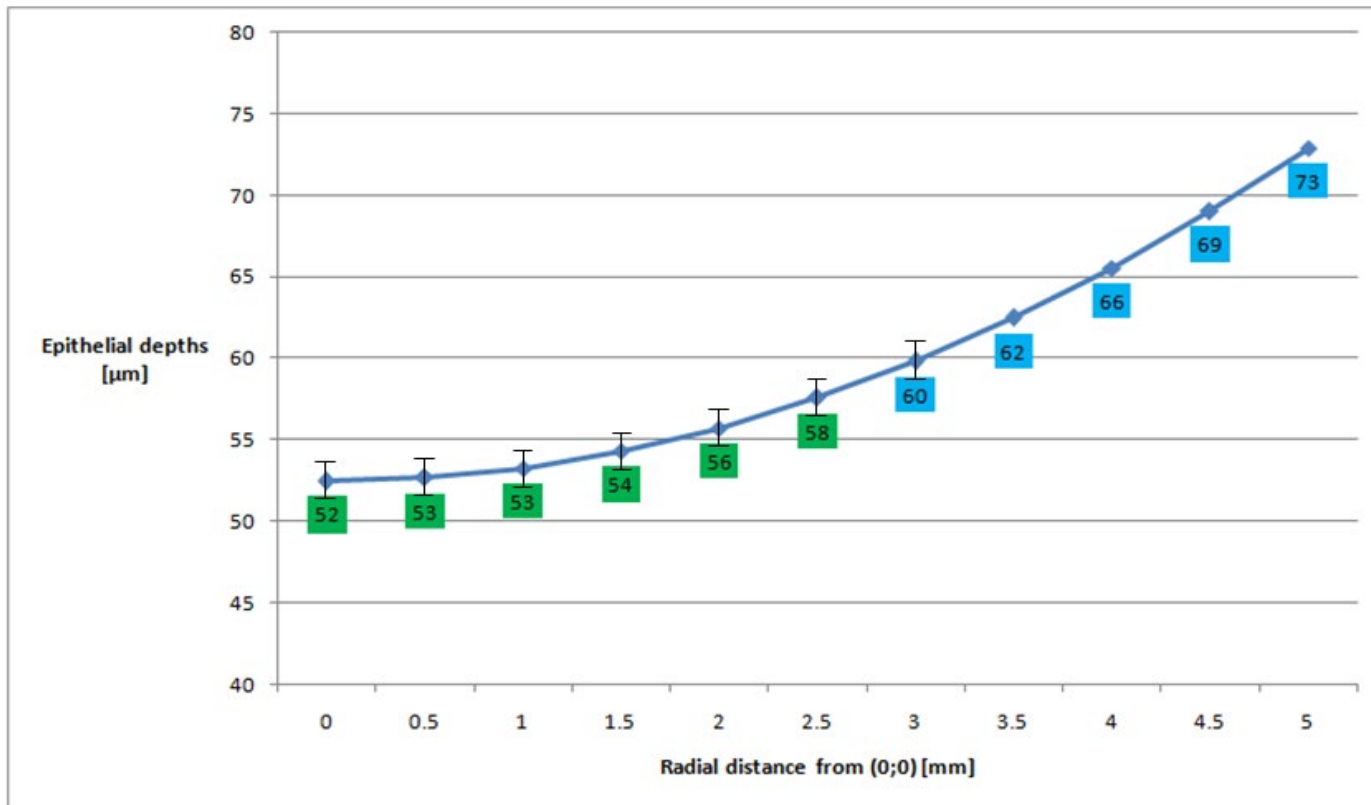




Method

- **$R_i = xE_{si} + yE_p$**
 - $i = 1 \dots n$, $n =$ treated eye number
 - **R_i** = the real value of ablation depth including the epithelium for each treated eye;
 - **E_{si}** = the expected value of the ablation depth of the stroma for each treated eye (1.48 μ per layer);
 - **E_p** = the constant default value used to ablate the epithelium (65 μ) ;
 - **x** = the correction constant to be defined for the stromal ablation;
 - **y** = the correction constant to be defined for the epithelial ablation;
 - **yE_p** = the corrected constant of the total epithelial ablation depth.
- The Least Squares method used to define x and y :
- Repeated for each radial zone from
 - 1mm to 10mm diameter
 - 1mm diameter steps

Results

Corrected epithelial thickness function



 Effective values
 Fitted values

Results

- **$x = 0.96$**
 - correction constant for pure stromal ablation vs. average epithelium and stroma ablation rate
 - 4% over-ablation
- **y_{Epj}**
 - range of variability in radial distance of the corrected function vs. the default value to ablate the epithelium from the center of the ablation up to 10 mm zone.
 - - 15.9% centrally
 - +15.9% peripherally,
 - unadjusted at 5mm zone

Results

- **$x = 0.96$**
 - Pre-adjustment assumed average ablation rate 1.48 μ per layer
 - Adjusted stromal ablation rate 1.42 μ per layer
- **$yE_{pj} = +/- 15.9\%$**
 - radial function in the range of +/- **15.9%** of the default value of 65 μ .

Conclusion

- Pre-adjustment estimate of epithelial thickness
 - Overestimate out to 10mm zone
 - Minimal effect on refractive outcome
 - Small stromal wastage
- Update has adjusted epithelial depth to established values
- Update has adjusted stromal ablation rate to established values