Does Artificial Intelligence hold the potential to improve the efficiency of therapeutic contact lens fitting in keratoconus?

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Background: Approximately 75% of corneal lenses are prescribed for keratoconus in the secondary care sector. Sometimes more than 3 lenses/eye are used during a fitting process that can take up one hour, sometimes more, of chair time. Could automative, objective, measurements of the cornea improve efficiency? Could AI improve efficiency by reducing chair time and wastage?

Methods: An audit was conducted to determine if there were significant correlates between the back optic zone radius (BOZR) and overall diameter (OD) of corneal lenses prescribed following routine fitting by conventional means and any of the characteristics obtained using Pentacam™. Data included pachymetry, at *highest point over the surface* (x_1) *at centre* (x_2) *of cornea*, & *mean Sim K* (x_3). The cases had been fitted with a range of lens designs including Rose K™ and QUASER™.

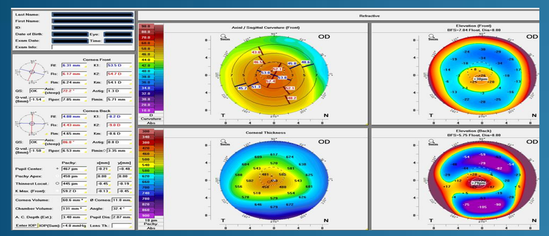


Figure 1 Pentacam Map

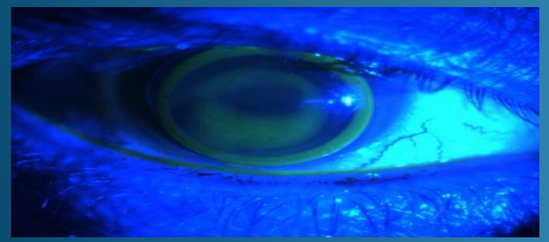


Figure 2 Rose K™ Contact lens on eye

Results: 69 cases were audited. Mean(±sd) BOZR, OD, of the prescribed lenses and x1,x2,&x3, corneal values were 6.88mm(±0.72),9.18mm(±0.35),457.6μ(±52.4),468.5μ(±49.7), 50.09D(±6.79). Preliminary analysis revealed several significant correlations between the finally prescribed BOZR, OD and various corneal characteristics determined by Pentacam ($p<0.01$). Key findings by multiple linear regression (MLR) were…..

i) $\log BOZR=0.205(\log x_1)-0.254(\log x_2)-0.824(\log x_3)+2.366$ ($r^2=0.920, p<0.001$)

ii) $\log OD=0.025(\log x_1)-0.102(\log x_2)-0.253(\log x_3)+1.598$ ($r^2=0.524, p<0.001$)

Conclusion: The results of MLR imply there is more than 90%, and 50%, chance of correctly predicting the final BOZR, and OD, of the corneal lens using machine measurements of x1,x2,&x3. Objective measures of the cornea, free of operator error and/or bias, could be incorporated into the AI algorithms with the aim of reducing both chair time & repeat visits, by more rapidly achieving an optimal contact lens fit.

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