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Algorithm-assisted subjective refraction in irregular corneas without and with scleral lenses

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Purpose: Algorithm-assisted refraction methods aim to improve the repeatability of refraction determination decreasing inter-examiner variability and eventually saving chair and clinician time. The purpose of the present study was to evaluate the agreement of subjective refraction and over-refraction conducted with conventional methods and with algorithm-based methods in challenging conditions: patients with corneal irregularities, either without and with scleral lens (SL).

Method: Non-cycloplegic over-refraction was determined with two methods: (1) retinoscopy and conventional subjective refraction (ConvSx); (2) Hartmann-Shack wavefront aberrometer followed by refraction with algorithm-based phoropter (AlgSx). Refraction was measured without any contact lens and 15 minutes after the application of a 16.4mm SL. The results of the spherical equivalent (M) and astigmatic components (J0 and J45) were compared between the two methods. High and low contrast visual acuity (HCVA and LCVA) were measured with the final ConvSx and AlgSx with ETDRS (LogMAR units).

Results: Nineteen eyes of 10 subjects with primary or secondary corneal ectasia were recruited. Mean M was more positive with AlgSx than with ConvSx without SL (-1.99±2.52D and -2.79±2.50D, respectively, p=0.325) and with SL (2.61±2.37D and 1.57±2.64D, respectively, p<0.001). No clinically or statistically significant differences were found for J0 and J45, either with or without SL. Although without statistically significant differences, HCVA was better with AlgSx without and with SL (0.17±0.14 vs 0.21±0.20 and 0.09±0.11 vs 0.12±0.16 LogMAR), and LCVA was better with AlgSx without lens (0.53±0.20 vs 0.59±0.22 logMAR) and better with ConvSx with SL (0.43±0.20 vs 0.47±0.15 LogMAR).

Conclusions: Refraction conducted with algorithm-assisted methods was on average more positive for comparable visual acuity outcomes. This suggests that in the hands of a trained vision specialist, the use of algorithm-assisted refraction might be a useful method to arrive to a final prescription with similar levels of reliability to conventional subjective refraction in subjects with corneal irregularities.