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Keratoconus Evaluation Using the ORBSCAN Topography System

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Purpose:

(1) Using the ORBSCAN Topography System, to compare the differences of the apex locations of keratoconus on Composite Map, Elevation Maps, Tangential (Instantaneous) Map, and Axial Map.

(2) Specific quantitative topographic parameters of the entire cornea were analyzed to further define topographic cone pattern in keratoconus patients using ORBSCAN Topography System.

Subjects and Methods:

ORBSCAN is 3-Dimensional Slit Scan Topography System. In part one of the study we reviewed topographic maps of 55 eyes of 36 patients with clinically diagnosed keratoconus. We evaluated cone location on 6 maps of each eye: Composite Map, Full Corneal Fit Anterior Elevation Map, Specific Fit Anterior Elevation Map, Periphery Fit Anterior Elevation Map, Instantaneous Map, and Axial Map. On each map, we defined the apex and took the following parameters: apex radius, semimeridian and apex values.

Distances between each pair of map apexes were calculated and compared. We categorized the 55 eyes into three groups by the composite apex radius and by the composite apex curvature respectively.

In part two of the study 61 eyes of 38 patients with keratoconus were evaluated. Specific quantitative topographic parameters of the entire cornea were analyzed to further define topographic cone pattern: the radius, the apex and the thinnest point. Evaluation included: Location, Elevation, Pachymetry, Tangential Curvature and Composite Curvature. Statistical analysis was performed in order to investigate the correlation of the apex parameters. The mirror image symmetry between the right eye and the left eye of an individual patient was also investigated.

Results:

Mean age of the 36 patients is 32.2±11.3 years. The entire group and all subgroups showed that the Elevation apex and Instantaneous apex were located closer to the center of the maps than Composite apex, while Axial apex was further than Composite apex. The mean distances from the composite apex increase monotonically in the following order: F-F elevation apex, S-F Elevation apex, P-F Elevation apex, Instantaneous apex and Axial apex. In the centered cone subgroup ($R \leq 1.0$ mm), all maps except axial map represent conical positions well, there are only slight differences from composite apex.

Mean age of the 38 patients is 31.2±12.2 years. There were 33 patients (86.8%) with bilateral keratoconus, 5 patients (13.2%) with unilateral keratoconus. Most of the cones were located inferior-temporally, only 3 cones of 61 eyes were located above the horizontal meridian. The mean distance between the apex and the thinnest point was 0.917±0.729 mm ($p<0.001$). Apex elevation had high correlation to apex composite curvature and apex tangential curvature ($r=0.94$ and 0.91, $p<0.001$). For right and left eyes, apex and thinnest point semimeridians correlated well ($r=0.471$ and 0.653, $p<0.05$), but the radii had no correlation ($r= 0.209$ and 0.243, respectively)

Conclusions:

Composite Map determines the exact location and the effect of corneal surface anomalies and should be used to define the conical shape and position of keratoconus patients. Full Corneal Fit Anterior Elevation Map presents accurate information in

defining the morphology of keratoconus. Instantaneous Map is better than Axial Map when evaluating keratoconus patients. The ORBSCAN topography system can provide us with more useful, more accurate information in defining the location of the cone of keratoconus, detecting subtle topographic changes present in early keratoconus and documenting their progression by serial topographic analysis and may be helpful to improve results of contact lens fitting and surgical management.