Table 6-3.

Ocular Landmarks (Surface Centers) Used by Orbscan

Surface Center	Definition	Type	Accuracy	Map mark (typically white)
Fixation reflex	Corneal reflex point of a fixating patient, measured by a coaxial optical system and corrected for acquisition misalignment	Fixed landmark	High	Oblique cross, x
Pachymetry minimum	Anterior corneal point with minimum normal thickness; defines the 2-surface optical axis of the cornea	Fixed landmark	Low	C
Anterior segment maximum	Anterior corneal point with maximum normal anterior segment depth; defines the 2-surface optical axis of the anterior cornea and lens combination	Fixed landmark	Low	S
Anterior corneal apex	Geometric center of the cornea, or the location where the axis of best anterior symmetry intersects the anterior surface	Fixed landmark	Low	Triangle
Entrance pupil	Physical pupil of the eye imaged through the cornea. Its center is taken to be the geometric centroid of the pupil image	Movable landmark	Medium	Dot
Sphere center (of an axisymmetric reference object)	View-axis projection of its apical center of curvature	Movable reference	Exact	Circle
View center	Point at which the view axis pierces the surface; placed at the map center in standard alignment	Movable reference	Exact	Black cross (map center)
Summit	Highest surface point measured with respect to the current view axis; placed on the view center (and therefore at map center) in standard alignment of a convex surface	Movable reference	High	
Instrument or system center	Point at which the instrument axis (defined by the video camera) pierces the data surface; if located on the unrotated anterior cornea, is a measure of acquisition misalignment	Fixed reference	High	

algorithm calculates the standard deviation of these values for the first zone and applies the formula for calculating irregularity. These calculations are repeated for each zone.

Optical surface irregularity is proportional to the standard deviation of surface curvature. Consequently, only axis-independent surface curvatures are used in the calculation, as only they are true surface properties. These include the mean curvature, which is a measure of local surface sphericity, and astigmatic curvature, which is a measure of local cylinder. As both curvature variations are important, the standard deviations of the mean and astigmatic curvature are statistically combined (their variances are added) to yield the irregularity in standard curvature units (reciprocal meters). Curvature in reciprocal meters can be converted to D by multiplying it by the surface refractive index difference, which is 0.3375 for the keratometric surface. Thus, the D equivalent of irregularity is about one-third the curvature measure in reciprocal meters.

Clinical Implications of Irregularity Calculations

Optical surface irregularity is important to the refractive surgeon because it often represents a loss in best-corrected visual acuity (BCVA). Regular astigmatism has a low irregularity, while irregular astigmatism has a high degree of irregularity. Higher-order aberrations (HOAs) may also have a high degree of irregularity. Measures of irregularity may also be useful as a supporting indicator (but not the sole indicator) in evaluating keratoconus. A 3-mm