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Cassini Ambient - Clinical FAQ Guide

This guide provides a comprehensive, surgeon-facing clinical FAQ for the Cassini Ambient. It is written for refractive cataract surgeons and is intended to support clinical decision-making, astigmatism management, toric IOL planning, arcuate incision planning, workflow integration, and outcome optimization. All responses are written in professional clinical language suitable for peer-to-peer reference.

The discussion is informed by published literature and clinical consensus. A selected list of references supporting these concepts is provided at the end of this document.

1. What is the Cassini Ambient corneal topographer?

Cassini Ambient is a color-LED, point-to-point corneal topography system designed to characterize corneal shape and astigmatism. Unlike Placido or Scheimpflug based systems that rely on concentric ring reflection and surface smoothness assumptions or oblique slit images, Cassini Ambient uses hundreds of uniquely identifiable LED points to reconstruct corneal geometry. This approach allows robust surface modeling, improved error detection, and enhanced stability in astigmatism magnitude and axis determination.

2. How does Cassini Ambient differ from Placido-based topographers?

Placido-based systems infer corneal curvature by analyzing reflected rings and fitting them to assumed smooth surfaces. Cassini Ambient instead analyzes discrete, identifiable points, allowing the system to recognize and reject inconsistent data rather than forcing a best-fit solution. Clinically, this translates into greater robustness (when repeatability criteria are met) in the presence of tear-film instability, localized irregularity, and decentration, as well as improved confidence in astigmatism axis measurements.

3. Does Cassini Ambient measure posterior corneal astigmatism?

Cassini Ambient is capable of analyzing both anterior and posterior corneal surfaces, enabling calculation of total corneal astigmatism (TCA). This avoids reliance on population-based assumptions regarding posterior corneal power and provides a more individualized representation of corneal astigmatism.

4. Why is total corneal astigmatism clinically important?

Posterior corneal astigmatism is systematic rather than random and is most oriented against-the-rule. Ignoring posterior corneal contribution may lead to consistent overcorrection of with-the-rule astigmatism and under correction of against-the-rule astigmatism. Even small posterior contributions can be clinically meaningful, particularly in premium cataract patients.

5. How does Cassini Ambient support toric IOL planning?

By providing total corneal astigmatism, magnitude and axis, Cassini Ambient helps surgeons better match toric IOL power and alignment to the patient's true corneal optics. Enhanced axis stability and inclusion of posterior corneal contributions support more informed astigmatism planning and may help reduce systematic planning bias.

6. When should total corneal astigmatism be prioritized over anterior-only keratometry?

Total corneal astigmatism is often prioritized when planning toric IOL implantation, managing against-the-rule or oblique astigmatism, addressing discordant keratometry across devices, and in premium cataract cases where refractive precision is critical. Anterior-only keratometry may still serve as a comparative reference.

7. How repeatable are Cassini Ambient measurements?

Cassini Ambient demonstrates high repeatability for keratometric values, astigmatism magnitude, and axis when proper acquisition protocols are followed (Ventura et al., 2015; Ferreria and Ribeiro, 2017). Clinically, repeatability across multiple captures is the most important indicator of measurement reliability and should be verified before surgical planning.

8. How should scan quality be assessed in routine practice?

Scan quality should be assessed by evaluating consistency of astigmatism magnitude and axis across repeated captures, stability of topographic patterns, and concordance with refraction history. Large axis shifts or inconsistent bow-tie patterns warrant repeat acquisition or ocular surface optimization. Scan quality in routine practice with Cassini Ambient should be assessed using the built-in Quality Factors displayed with each acquisition. In clinical use, technicians and surgeons should confirm that focus, centration, corneal coverage, stability, and posterior quality indicators meet acceptable thresholds (as shown by percentage values and color coding on the report) before accepting a scan. These metrics collectively verify proper alignment, adequate LED coverage, minimal motion artifact, and sufficient posterior

surface detection. Scans meeting these Quality Factor criteria can be considered reliable for preoperative planning, while scans that do not should be reacquired. This approach enables consistent, objective quality control without adding chair time and supports standardized acquisition in routine practice.

9. How does ocular surface disease affect Cassini measurements?

As with all corneal imaging technologies, tear-film instability can influence measurement quality. Inter-scan variability exceeding established repeatability limits (e.g., > X%) may indicate tear-film–related effects and prompt scan reacquisition. Cassini Ambient mitigates this through redundant point sampling and rejection of inconsistent data; however, optimal results require appropriate management of dry eye and meibomian gland dysfunction prior to measurement.

10. How should discrepancies between Cassini Ambient and biometers be managed?

When discrepancies arise, surgeons should first assess repeatability within each device. Axis agreement should be prioritized over small magnitude differences. Additional clinical context, including manifest refraction history and fellow-eye symmetry, should be incorporated into final decision-making.

11. Is Cassini Ambient useful for arcuate incisions and LRIs?

Yes. Total corneal astigmatism is particularly relevant for arcuate and limbal relaxing incision planning, where posterior corneal contribution can significantly influence outcomes, especially in low-magnitude astigmatism corrections.

12. How does Cassini Ambient perform in post-refractive surgery eyes?

Post-LASIK, PRK, and RK corneas often violate assumptions inherent to ring-based systems (Koch et al, 2012; Gatinel and Saad, 2012). Cassini Ambient's point-based reconstruction improves characterization of these corneas, though conservative planning and strict repeatability criteria are recommended.

13. Can Cassini Ambient be used in irregular corneas or ectasia?

Cassini Ambient can aid in characterizing irregular astigmatism patterns. Toric IOL implantation should be considered only when astigmatism is

predominantly regular, stable, and repeatable, with appropriate patient counseling.

14. What are common causes of unreliable measurements and how can they be addressed?

Common causes include tear-film instability, poor fixation, lid shadowing, and recent contact lens wear. These factors should be corrected through surface treatment, patient coaching, and repeat acquisition rather than averaging inconsistent scans. These issues can be addressed by optimizing the ocular surface (e.g., blinking prior to capture or using lubricants when appropriate), reinforcing patient fixation and positioning, ensuring adequate corneal exposure, and observing appropriate contact lens washout periods.

15. How should low-cylinder toric IOLs be planned using Cassini Ambient?

In low-cylinder cases, posterior corneal contribution and axis accuracy become more important. When Cassini Ambient demonstrates stable TCA axis repeatability (Ventura et al, 2015; Ferreira & Ribeiro, 2017), this information is often prioritized to reduce residual astigmatism.

16. How should Cassini Ambient data be interpreted in eyes with large angle kappa or alpha?

Cassini Ambient measures corneal geometry independent of visual axis alignment. Surgeons should incorporate centration strategy and visual axis considerations when planning premium IOLs.

17. Does Cassini Ambient replace intraoperative aberrometry?

No. Cassini Ambient and intraoperative aberrometry provide complementary information. Many surgeons use Cassini Ambient for primary corneal astigmatism planning and intraoperative aberrometry as a confirmatory tool in selected cases.

18. How should Cassini Ambient be used in eyes with prior corneal incisions or scars?

Cassini Ambient can help differentiate regular from irregular astigmatism by combining point-based corneal reconstruction with objective quality and consistency indicators, rather than relying solely on smooth ring symmetry. When irregular components dominate or axis stability is poor, conservative or non-toric strategies should be considered.

19. Can Cassini Ambient assist with toric IOL alignment strategy?

Yes. Cassini Ambient data can be digitally transferred into compatible image-guided surgical systems to support intraoperative alignment and help minimize cumulative sources of variability associated with manual marking and cyclotorsion.

20. How does Cassini Ambient perform in long axial length eyes?

Axial length does not directly influence corneal topography measurements. Cassini Ambient characterizes corneal shape and astigmatism independently of axial length. In eyes with longer axial lengths, careful astigmatism characterization remains important given higher refractive expectations.

21. Should Cassini Ambient measurements be repeated on different days?

Repeat-day measurements are not routinely required but may be helpful when ocular surface disease is being treated, when scans show borderline repeatability, or when measurements conflict with clinical expectations.

22. How are cyclotorsion considerations addressed?

Cassini Ambient provides a preoperative astigmatism reference for surgical planning. Cyclotorsion is managed intraoperatively by image-guided alignment systems (e.g., femtosecond laser or OR guidance platforms), rather than by the diagnostic device itself.

23. Is Cassini Ambient useful for postoperative outcome analysis?

Yes. Cassini Ambient can be used postoperatively to evaluate residual corneal astigmatism, distinguish corneal versus lenticular contributors, and support vector-based nomogram refinement.

24. How should Cassini Ambient be incorporated into nomogram refinement?

Nomogram refinement should be based on consistent use of measurement methodology and longitudinal analysis of postoperative outcomes rather than isolated cases.

25. Can Cassini Ambient help identify eyes at risk for refractive surprise?

Large discrepancies between anterior-only and total corneal astigmatism, poor repeatability, and irregular patterns may signal increased risk and warrant adjusted planning or counseling.

26. How should fellows and new surgeons be trained to use Cassini Ambient?

Training should emphasize acquisition quality, repeatability assessment, pattern recognition, and integration with other clinical data rather than reliance on a single measurement.

27. Does Cassini Ambient increase clinic time or complexity?

When incorporated into a standardized workflow with trained technicians, Cassini Ambient typically does not increase chair time. This integration supports more efficient and consistent astigmatism planning during preoperative evaluation.

28. How should Cassini Ambient data be documented medico-legally?

Documentation should reflect that total corneal astigmatism was assessed, measurements were repeatable, and data were used in conjunction with other standard diagnostic inputs.

29. Which patient populations benefit most from Cassini Ambient?

Patients most likely to benefit include toric IOL candidates, premium cataract patients, eyes with ATR or oblique astigmatism, and post-refractive surgery eyes.

30. What is the key clinical takeaway for cataract surgeons?

Cassini Ambient provides a comprehensive assessment of corneal astigmatism by incorporating posterior corneal contribution and improving axis confidence. When used with proper acquisition protocols and clinical judgment, it supports confidence in refractive planning and decision-making.

31. How do I utilize the HOA values?

Higher-order aberrations (HOAs) are a measure of how the cornea affects light propagation and are expressed in microns (μm) as a root mean square (RMS) value. Cassini Ambient measures the magnitude of corneal HOAs for both mesopic and photopic zones and reports total HOA values. Dr. Jack Holladay

offers threshold criteria as suggested guidance when analyzing total HOAs for multifocal or EDOF IOL selection.

RMS HOA (Wavefront Error) at 6.0 mm – General Guidance:

- ≤0.370µm — Generally acceptable
- 0.371-0.599µm — Caution advised
- ≥0.660µm — Increased concern
- ≥1.000µm — Generally considered unfavorable

32. What is Surface Regularity Index (SRI) and Surface Asymmetry Index (SAI)?

Surface Regularity index (SRI) is a measure of corneal surface regularity; elevated values may be observed when the surface is irregular, such as in cases of dry eye disease or anterior basement membrane dystrophy (ABMD). Surface Asymmetry Index (SAI) is considered abnormal when the corneal surface demonstrates asymmetry. Conditions commonly associated with elevated SAI values include keratoconus, pellucid marginal degeneration, Salzmann's nodules, and corneal scarring.

According to Dr. Swanic*, these values are not for clinical diagnosis but suggested as screening tools that may be used to prompt further clinical evaluation.

- <1.00 — Normal
- 1.0 to 1.7 — Caution
- >1.7 — Abnormal

*Matthew Swanic, MD, Cassini Topography Review: Topography of the 21st Century (cassini-technologies.com). September 1, 2023.

33. What is the difference between the Asphericity (Q coefficient) and Spherical Aberration (SA)?

Asphericity (Q coefficient) is a factor that tells us how much and in what manner the cornea flattens from the apex toward the periphery. The Q value has no assigned units. Cassini Ambient provides a positive or negative Q coefficient (not an absolute value). Spherical Aberration (SA) describes how a wavefront deviates from the ideal after passing through a refracting surface. The human cornea generally has a positive SA, which does not vary significantly with aging. Human corneal SA has been reported to be approximately +0.27 µm for a 6.0 mm diameter. The clearest image is achieved when the total spherical aberration value for the eye is 0.00.

Corneal SA @6mm	Approved IOLs *†	Manufacturer IOL SA
<+0.1µm	Envista/SofPort AO *(B+L)*†	zero
>+0.1µm to <+0.235µm	Clareon/AcrySof IQ (*Alcon*)†	-0.20µm
>+0.235µm	Tecnis/Tecnis II (*J&J Vision*)†	-0.27µm

* *Packer, M. The plus and minuses of aspheric IOLs. Review of Ophthamology. January 14, 2009.*
† *These IOL designs are US FDA approved for the correction of spherical aberration.*

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The references listed support general clinical principles discussed in this document and are not intended to represent device-specific performance claims.