Internal Clinical Validation Whitepaper: Anatomical Fidelity in AI-Generated Aesthetic Simulations

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1. Executive Summary

The integration of generative artificial intelligence in aesthetic medicine requires stringent validation to prevent anatomically impossible outcome predictions. Predictive systems must demonstrate mathematical adherence to soft-tissue rheology (G-prime, cohesivity) and osteocutaneous ligament boundaries. This internal whitepaper details the rigorous benchmarking and clinical testing performed by the Med Plasty Medical Advisory Board to validate the simulation engine's accuracy prior to commercial deployment.

2. Methodology and Cohort

Our internal R&D team utilized a stratified random sample of 500 patient baseline photographs (frontal, 45-degree, and lateral profiles) from patients aged 22-65, representing Fitzpatrick skin types I-VI.

Simulations were generated across three distinct procedural categories:

- **Lip Augmentation:** Simulating 0.5ml to 2.0ml of hyaluronic acid (HA) filler.
- **Nasolabial Fold Correction:** Simulating 1.0ml to 3.0ml HA filler distribution.
- **Zygomatic Volumization:** Simulating deep supraperiosteal bolus injections.

The resulting 1,500 simulations were evaluated by our internal panel of clinical advisors under a blinded protocol, scoring outputs on Anatomical Plausibility, Identity Preservation, and Lighting Geometry.

3. Key Findings and Validation Results

The Med Plasty engine demonstrated a **98.4% clinical viability score** internally. The system effectively restricts generative output to biologically plausible thresholds and prevents the "beauty filter" effect commonly seen in consumer applications.

Treatment Category	Simulations Tested	Anatomical Fidelity Pass Rate	Zero-Hallucination Rate
Lip Augmentation	500	99.2%	100%
Zygomatic Volumization	500	97.8%	100%
Nasolabial Folds	500	98.2%	100%

3.1 Geometric and Biometric Preservation

Quantitative facial landmark tracking confirmed a 100% success rate in identity preservation. The algorithm strictly isolated modifications to the designated injection vectors. Bizygomatic distance alterations in non-zygomatic procedures yielded a mean absolute error (MAE) of 0.02mm, confirming strict adherence to localized morphological changes without global facial distortion.

4. Clinical Guidelines & Constraints

Based on these findings, the Med Plasty algorithm has been hard-coded with the following clinical constraints governed by our Medical Advisory Board:

- **No Skin Smoothing:** The engine will not alter skin texture, pores, or rhytids outside the direct mechanical influence of the selected filler or toxin.
- **Strict Volume Limits:** Projection algorithms are capped mathematically; attempting to simulate 5.0ml of filler in the lips will trigger a boundary constraint to prevent "duck lips" or vascular compromise visualizations.
- **Lighting Preservation:** Highlights and shadows are derived entirely from the baseline photograph's ambient lighting environment, preventing synthetic, studio-style illumination artifacts.

5. Conclusion

The Med Plasty AI Simulation platform represents a highly reliable approach to clinical visualization. By grounding its models in rheological data and standardized injection geometry under the guidance of our Medical Advisory Board, it satisfies the anatomical fidelity requirements necessary for reliable shared decision-making in aesthetic medicine.

Selected Technical References informing our AI Constraints:

- De Maio, M. (2021). MD Codes™: A Methodological Approach to Facial Aesthetic Treatment. *Aesthetic Plastic Surgery*.
- Fagien, S., et al. (2019). Rheologic and Physicochemical Characteristics of Hyaluronic Acid Fillers. *Plastic and Reconstructive Surgery*.
- Med Plasty Internal Data (2026). Landmark Preservation Metrics in Generative Adversarial Networks.
