



THE EVIDENCE BASE

What Noova is built on

129

PEER-REVIEWED PAPERS

Every paper behind the Noova scoring model, grouped by what it informs.
Each entry states what the study **found** and what we **took from it**.

Every DOI has been machine-verified to resolve against Crossref and
PubMed. No fabricated citations.

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Papers often inform more than one signal; each is listed once, under its primary one.

What skin hydration is, how it is properly measured, and therefore what a camera can and cannot claim.

1 Stratum corneum hydration in healthy adult humans according to the skin area, age and sex: a systematic review and meta-analysis

Samadi A, et al. · *Journal of the European Academy of Dermatology and Venereology : JEADV*, 2022 · <https://doi.org/10.1111/jdv.18297> · P001

FOUND Pooled corneometer SC-hydration ranged from a low of 12.5 (95% CI 11.05-13.94) on the back to a high of 64.34 (95% CI 62.07-64.59) on the periorbital area.

WE TOOK Site-specific corneometer capacitance anchors (facial/periorbital run high) for calibrating a hydration signal; but corneometry is a contact capacitance probe, so a camera cannot directly read SC water content.

2 Transepidermal water loss in healthy adults: a systematic review and meta-analysis update

Akdeniz M, et al. · *The British journal of dermatology*, 2018 · <https://doi.org/10.1111/bjd.17025> · P002

FOUND TEWL reference values ranged from a low of 2.3 g/m²/h (95% CI 1.9-2.7) on breast skin to a high of 44.0 g/m²/h (95% CI 39.8-48.2) on the axilla across 212 studies.

WE TOOK Site-dependent TEWL reference ranges anchor the barrier-proxy interpretation of hydration; TEWL requires a probe measuring water flux, which a camera cannot capture.

3 Devices measuring transepidermal water loss: A systematic review of measurement properties

Klotz T, et al. · *Skin research and technology : official journal of International Society for Bioengineering and the Skin (ISBS) [and] International Society for Digital Imaging of Skin (ISDIS) [and] International Society for Skin Imaging (ISSI)*, 2022 · <https://doi.org/10.1111/srt.13159> · P003

FOUND A reliability review examined 22 TEWL measurement devices across 38 included studies, finding good reliability but highly variable measurement error.

WE TOOK Establishes that even instrumented TEWL has highly variable measurement error across 22 devices, setting an upper bound on precision; a camera-based hydration estimate cannot match probe-grade barrier measurement.

4 Effects of Oral Collagen for Skin Anti-Aging: A Systematic Review and Meta-Analysis

Pu SY, et al. · *Nutrients*, 2023 · <https://doi.org/10.3390/nu15092080> · P004

FOUND In 26 RCTs (1721 patients), hydrolyzed collagen significantly improved skin hydration (overall effect Z = 4.94, p < 0.00001) and elasticity (Z = 4.49, p < 0.00001) versus placebo.

WE TOOK Quantifies oral-collagen hydration effect size for treatment-response context; measured via corneometry not imaging, so the hydration gain is not directly visible to a camera.

5 Effects of Collagen Supplements on Skin Aging: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Myung SK, et al. · *The American journal of medicine*, 2025 · <https://doi.org/10.1016/j.amjmed.2025.04.034> · P005

FOUND A meta-analysis of 23 RCTs with 1474 participants found collagen improved hydration overall, but the effect vanished in non-industry-funded and high-quality studies.

WE TOOK Cautions that collagen hydration benefits are funding/quality-dependent; relevant when weighting supplement claims but not a corneometry/TEWL anchor and unrelated to camera-readable signals.

6 Effects of hydrolyzed collagen supplementation on skin aging: a systematic review and meta-analysis

de Miranda RB, et al. · *International journal of dermatology*, 2021 · <https://doi.org/10.1111/ijd.15518> · P006

FOUND Across 19 studies (1,125 participants aged 20-70, 95% women), 90 days of hydrolyzed collagen improved skin hydration, elasticity, and wrinkles versus placebo.

WE TOOK Supports a ~90-day timescale for measurable hydration change from ingestibles; hydration was instrument-measured, reinforcing that a camera cannot directly grade SC water content.

7 Exploring the Impact of Hydrolyzed Collagen Oral Supplementation on Skin Rejuvenation: A Systematic Review and Meta-Analysis

Dewi DAR, et al. · *Cureus*, 2023 · <https://doi.org/10.7759/cureus.50231> · P007

FOUND A meta-analysis of 14 studies (967 participants) found a 12-week hydrolyzed collagen regimen substantially enhanced skin moisture and elasticity versus placebo.

WE TOOK Adds a 12-week efficacy datapoint for hydration interventions; moisture measured instrumentally, so gains are not directly observable in a photo.

8 The impact of dupilumab on skin barrier function: A systematic review

Montero-Vilchez T, et al. · *Journal of the European Academy of Dermatology and Venereology : JEADV*, 2023 · <https://doi.org/10.1111/jdv.19081> · P008

FOUND Across 6 studies (233 participants), dupilumab decreased TEWL, and 33.6% (2/6) reported increased stratum corneum hydration on eczematous lesions.

WE TOOK Shows SCH and TEWL as the standard non-invasive readouts of barrier repair; both need probes, underscoring that a camera cannot directly read SC hydration.

9 Restoration of Skin Barrier Abnormalities with IL4/13 Inhibitors and Jak Inhibitors in Atopic Dermatitis: A Systematic Review

Chatzigeorgiou I, et al. · *Medicina (Kaunas, Lithuania)*, 2024 · <https://doi.org/10.3390/medicina60081376> · P009

FOUND A review of 12 studies (378 dupilumab and 38 JAK-inhibitor participants) found significant TEWL decreases and stratum corneum hydration increases on eczematous lesions.

WE TOOK Reinforces TEWL/SCH as coupled barrier-and-hydration endpoints in treatment response; both are instrument-based, not camera-derived.

10 Clinical Measurement of Transepidermal Water Loss

Kundu D, et al. · *Advances in wound care*, 2026 · <https://doi.org/10.1089/wound.2024.0148> · P010

FOUND The FDA defines complete wound closure as 100% re-epithelialization verified across two assessments at least 14 days apart, yet high post-healing TEWL still predicts recurrence.

WE TOOK Illustrates that visible surface healing (camera-observable) can diverge from functional barrier status, which only TEWL detects, mirroring the limit of imaging-based hydration scoring.

11 Transepidermal water loss (TEWL): Environment and pollution-A systematic review

Green M, et al. · *Skin health and disease*, 2022 · <https://doi.org/10.1002/ski2.104> · P011

FOUND Across 15 studies (11 on environment/season, 4 on pollution), all four pollution studies showed increased TEWL with particulate-matter or NO2 exposure.

WE TOOK Flags environmental confounders (pollution, season) that shift TEWL/barrier state; useful context for interpreting hydration variability, and a factor a static camera image cannot control for.

12 The Skin Barrier and Moisturization: Function, Disruption, and Mechanisms of Repair

Rajkumar J, et al. · *Skin pharmacology and physiology*, 2023 · <https://doi.org/10.1159/000534136> · P012

FOUND The review models the skin barrier as four interdependent layers (physical, chemical, microbiologic, immunologic), with moisturizers shown to improve transepidermal water loss.

WE TOOK Mechanistic framing for how occlusives/humectants/emollients lower TEWL and raise SC hydration, supporting product-match logic; the underlying hydration change is measured by probe, not imaging.

13 Facial skin ageing: Key concepts and overview of processes

Zargaran D, et al. · *International journal of cosmetic science*, 2022 · <https://doi.org/10.1111/ics.12779> · P013

FOUND A review of 65 papers found combined intrinsic and extrinsic aging pathways impair skin barrier function alongside wrinkles, laxity, and thinning.

WE TOOK Context that aging degrades barrier/hydration function; relevant to age-adjusting hydration expectations but provides no corneometry/TEWL number and no camera-readable metric.

14 Clinical Efficacy of a Salicylic Acid-Containing Gel on Acne Management and Skin Barrier Function: A 21-Day Prospective Study

Liu Y, et al. · *Journal of cosmetic dermatology*, 2025 · <https://doi.org/10.1111/jocd.70353> · P058

FOUND In 42 acne participants using a salicylic-acid gel for 21 days, Sebumeter SM815 sebum levels decreased by 23.65% while hydration rose 40.5%.

WE TOOK Anchors magnitude of achievable sebum change (~24% over 3 weeks) measured on Sebumeter SM815 in oily/combination skin; calibrates what an 'improving oil-balance' trajectory looks like.

Acne grading scales, and how reliably photo-based systems reproduce a clinician's grade.

15 Prevalence and risk factors of acne scars in patients with acne vulgaris

Liu L, et al. · *Skin research and technology : official journal of International Society for Bioengineering and the Skin (ISBS) [and] International Society for Digital Imaging of Skin (ISDIS) [and] International Society for Skin Imaging (ISSI)*, 2023 · <https://doi.org/10.1111/srt.13386> · P014

FOUND The pooled prevalence of acne scars among acne patients was 47% (95% CI 38-56%), with severe acne carrying an odds ratio of 5.51 for scarring.

WE TOOK Anchors how often blemishes progress to permanent scars; clarity scoring should weight active-lesion severity as a downstream scarring predictor.

16 Topical Retinoids in Acne Vulgaris: A Systematic Review

Kolli SS, et al. · *American journal of clinical dermatology*, 2019 · <https://doi.org/10.1007/s40257-019-00423-z> · P015

FOUND A topical retinoid plus an oral antibiotic reduced acne lesion counts by 64-78.9% versus 41-56.8% for vehicle ($p < 0.001$).

WE TOOK Gives realistic lesion-count reduction ranges over a treatment course, calibrating how much clarity change a scan should expect between visits.

17 Management of Acne Vulgaris: A Review

Eichenfield DZ, et al. · *JAMA*, 2021 · <https://doi.org/10.1001/jama.2021.17633> · P016

FOUND In a 207-patient RCT, tretinoin 0.025% gel monotherapy reduced acne lesion counts by 63% versus baseline at 12 weeks.

WE TOOK Provides a concrete 12-week lesion-clearance benchmark (63%) that clarity trend deltas can be calibrated against.

18 Systematic review of the epidemiology of acne vulgaris

Heng AHS, et al. · *Scientific reports*, 2020 · <https://doi.org/10.1038/s41598-020-62715-3> · P017

FOUND Overweight/obese BMI (pooled OR 2.36, 95% CI 1.97-2.83) and parental family history (pooled OR 2.91, 95% CI 2.58-3.28) were strongly associated with acne presentation/severity.

WE TOOK Quantifies non-visual risk factors (BMI, family history) that clarity scoring cannot read from a photo but that contextualize baseline blemish likelihood.

19 Epidemiology of acne vulgaris

Bhate K, et al. · *The British journal of dermatology*, 2013 · <https://doi.org/10.1111/bjd.12149> · P018

FOUND Acne persists into the 20s and 30s in around 64% and 43% of individuals respectively, and moderate-to-severe acne affects around 20% of young people.

WE TOOK Shows clarity is an ongoing adult concern, not adolescent-only, supporting age-agnostic clarity grading expectations.

20 Safety and Effectiveness of Oral Nutraceuticals for Treating Acne: A Systematic Review

Shields A, et al. · *JAMA dermatology*, 2023 · <https://doi.org/10.1001/jamadermatol.2023.3949> · P019

FOUND Of 2582 abstracts screened, 42 RCTs (3346 participants) met inclusion, with fair/good-quality studies showing decreased lesion counts or improved IGA for vitamins B5/D, green tea, probiotics and omega-3.

WE TOOK Evidence base for oral adjuncts tied to lesion-count/IGA outcomes, informing which non-topical factors could plausibly shift a clarity score.

21 Guidelines of care for the management of acne vulgaris

Reynolds RV, et al. · *Journal of the American Academy of Dermatology*, 2024 · <https://doi.org/10.1016/j.jaad.2023.12.017> · P020

FOUND The 2024 AAD acne guideline issued 18 evidence-based recommendations and 5 good practice statements, with strong recommendations for benzoyl peroxide, topical retinoids, topical antibiotics and oral doxycycline.

WE TOOK Authoritative treatment framework mapping severity to interventions, useful for grounding clarity-based product/routine recommendations.

22 "Acne vulgaris: key insights, treatment, and future prospects"

Bhatt J, et al. · *Molecular diversity*, 2026 · <https://doi.org/10.1007/s11030-025-11209-3> · P021

FOUND Acne vulgaris is the 8th most treated skin condition and affects over 80% of teenagers globally.

WE TOOK Establishes near-universal adolescent prevalence, so a clear reading in that group is meaningfully above baseline expectation.

23 Acne-induced Post-inflammatory Hyperpigmentation: From Grading to Treatment

Auffret N, et al. · *Acta dermato-venereologica*, 2025 · <https://doi.org/10.2340/actadv.v105.42925> · P022

FOUND Acne-induced post-inflammatory hyperpigmentation is mainly observed in patients with Fitzpatrick Phototypes IV to VI.

WE TOOK Camera/skin-tone caveat: residual pigment from cleared blemishes concentrates in darker phototypes, so clarity scoring must separate active lesions from PIH by skin tone.

24 Diet and acne: A systematic review

Meixiong J, et al. · *JAAD international*, 2022 · <https://doi.org/10.1016/j.jdin.2022.02.012> · P023

FOUND From 410 articles screened, 34 met inclusion; high glycemic index and glycemic load were positively associated with acne severity, supported by RCTs.

WE TOOK Diet is a modifiable, non-visual driver of blemish severity that clarity scoring cannot read directly but can flag as a contributing factor.

25 Adolescent acne vulgaris: current and emerging treatments

Layton AM, et al. · *The Lancet. Child & adolescent health*, 2023 · [https://doi.org/10.1016/s2352-4642\(22\)00314-5](https://doi.org/10.1016/s2352-4642(22)00314-5) · P024

FOUND Acne vulgaris has a peak prevalence between age 15 and 20 years across all ethnicities and races.

WE TOOK Defines the age window where lower clarity is statistically expected, useful for age-normalized clarity interpretation.

26 Low-dose oral isotretinoin for the treatment of adult patients with mild-to-moderate acne vulgaris: Systematic review and meta-analysis

Al Muqarrab F, et al. · *Dermatologic therapy*, 2022 · <https://doi.org/10.1111/dth.15311> · P025

FOUND Conventional isotretinoin dosing is 0.5-1.0 mg/kg per day to a cumulative dose of 120-150 mg/kg, and conventional dosing improved prolonged-remission odds over low doses.

WE TOOK Severity-treatment threshold context: isotretinoin marks the severe end of the clarity spectrum where sustained clearance is the goal.

27 Update to acne vulgaris treatment for Canadian practice

Keow S, et al. · *Canadian family physician Medecin de famille canadien*, 2025 · <https://doi.org/10.46747/cfp.710708455> · P026

FOUND The Canadian update applied the 2024 AAD acne guidelines, reviewing approved treatments for patients aged 9 and older with GRADE-rated evidence.

WE TOOK Reinforces severity-tiered treatment mapping (topical for mild, oral for moderate-severe) that clarity-graded routine suggestions can follow.

28 Development and validation of an artificial intelligence-powered acne grading system incorporating lesion identification

Li J, et al. · *Frontiers in medicine*, 2023 · <https://doi.org/10.3389/fmed.2023.1255704> · P027

FOUND An AI acne severity grader reached a linear weighted kappa of 0.652 against physician labels, rising to 0.737 and 0.696 once lesion-identification results were integrated with fixed and learnable weights.

WE TOOK Concrete reliability anchor: automated image-based acne severity grading tops out around weighted kappa 0.65-0.74 vs physicians, and explicit lesion detection (precision 0.507/recall 0.775) meaningfully lifts agreement, calibrating what noova's camera-driven clarity score can credibly claim.

29 Artificial Intelligence in the Assessment and Grading of Acne Vulgaris: A Systematic Review

Traini DO, et al. · *Journal of personalized medicine*, 2025 · <https://doi.org/10.3390/jpm15060238> · P028

FOUND Across 29 included studies, AI acne diagnosis/lesion-counting/severity-grading models reached accuracy as high as 97.6% in controlled settings.

WE TOOK Ceiling reference for image-based clarity scoring: peak 97.6% accuracy is controlled-setting only, and the review flags dataset/ethnic-bias and external-validation gaps that bound how far noova can trust a camera-only acne clarity read across diverse users.

30 Inter-rater variability and consistency within four acne grading systems recommended in China, USA, and Europe

Yu R, et al. · *Journal of cosmetic dermatology*, 2022 · <https://doi.org/10.1111/jocd.15178> · P029

FOUND Four acne grading systems (AGS, IIGS, IGA, GEA) applied by four investigators across 1107 acne patients showed excellent reliability and were significantly correlated with each other ($p \leq 0.01$).

WE TOOK Supports interchangeability of major acne grading anchors (including US IGA and European GEA): different validated severity scales track together ($p \leq 0.01$), so noova can map its clarity output onto IGA/GEA-style bands without conflicting ground truth.

31 Comparisons of Four Acne Grading Systems Recommended in China, Korea, and Japan

Yu R, et al. · *Clinical, cosmetic and investigational dermatology*, 2023 · <https://doi.org/10.2147/ccid.s400226> · P030

FOUND Across 1107 acne patients rated by five investigators, four grading systems (AGS, IIGS, KAGS, JAGS) showed strong correlations with one another ($P \leq 0.01$).

WE TOOK Reinforces cross-scale consistency for acne severity anchors used in China/Korea/Japan; strong inter-scale correlation ($P \leq 0.01$) and reported strong intra-grader reliability mean a well-defined lesion-severity grade is reproducible enough to serve as a clarity training target.

32 Acne Vulgaris and adherence to the mediterranean diet among university students: a case-control study

Taha S, et al. · *Journal of health, population, and nutrition*, 2024 · <https://doi.org/10.1186/s41043-024-00535-1> · P031

FOUND In a GAGS-graded case-control study, family history of acne differed between cases and controls (OR = 2.01, CI 1.17-3.44) while Mediterranean-diet adherence did not (OR = 0.86, CI 0.46-1.60).

WE TOOK Uses GAGS as the operational acne-severity instrument and quantifies non-image drivers: a camera reads lesion severity but cannot capture family history (OR 2.01), marking a clarity-score boundary where noova should defer to self-reported risk factors.

33 Comparative Efficacy of Pharmacological Treatments for Acne Vulgaris: A Network Meta-Analysis of 221 Randomized Controlled Trials

Huang CY, et al. · *Annals of family medicine*, 2023 · <https://doi.org/10.1370/afm.2995> · P103

FOUND In a network meta-analysis of 221 RCTs, oral isotretinoin produced the largest mean percentage reduction in total acne lesions (MD = 48.41), followed by topical retinoid + BPO triple therapy (MD = 38.15).

WE TOOK Anchors high %-match for retinoid-containing acne products; topical retinoid + BPO triple therapy (~38% lesion reduction) ranks near the top of 37 interventions.

34 Topical benzoyl peroxide for acne

Yang Z, et al. · *The Cochrane database of systematic reviews*, 2020 · <https://doi.org/10.1002/14651858.cd011154.pub2> · P109

FOUND Topical benzoyl peroxide improved participant-reported acne versus placebo with RR 1.27 (95% CI 1.12-1.45) over 10-12 weeks.

WE TOOK Grades BPO acne products; RR 1.27 improvement (little difference vs adapalene/clindamycin) supports a moderate %-match.

35 Efficacy and Tolerability of a Novel Cosmetic and Over-the-Counter Facial Acne Regimen Versus a Prescription Treatment

Huang P, et al. · *Journal of cosmetic dermatology*, 2025 · <https://doi.org/10.1111/jocd.16568> · P114

FOUND An OTC salicylic acid acne regimen significantly improved Investigator's Global Assessment of acne severity from 48h through week 12 ($p \leq 0.001$), comparable to a prescription adapalene/BPO regimen.

WE TOOK Supports salicylic acid (BHA) OTC %-match; matched prescription adapalene/BPO on acne severity ($p \leq 0.001$) with better tolerance.

Validated roughness and wrinkle scales, and how photo grades compare against instruments.

36 Development and Validation of a Photonumeric Scale for Evaluation of Facial Skin Texture

Donofrio L, et al. · *Dermatologic surgery : official publication for American Society for Dermatologic Surgery [et al.]*, 2016 · <https://doi.org/10.1097/dss.0000000000000852> · P032

FOUND In a 290-subject validation of the 5-point Allergan Skin Roughness Scale, intrarater agreement across the 2 sessions was almost perfect at weighted kappa = 0.83.

WE TOOK Anchors a validated 5-grade midface roughness scale (kappa 0.83) noova can map camera-visible roughness bins to; a ≥ 1 -point change is clinically meaningful.

37 Development and Validation of the Cheek Smoothness Scale: A Photonumeric Assessment Tool for Cheek Skin Texture

Han HS, et al. · *Journal of cosmetic dermatology*, 2026 · <https://doi.org/10.1111/jocd.70806> · P033

FOUND The Cheek Smoothness Scale is a five-grade photonumeric scale whose reliability was assessed by five board-certified dermatologists on single-angle (45 degrees) and multi-angle images, with grades tracking rising PRIMOS Ra values.

WE TOOK Validates a 5-grade smoothness scale against objective PRIMOS Ra and confirms a single 45-degree oblique photo suffices, supporting noova's single-angle camera texture grading.

38 Skin measurement devices to assess skin quality: A systematic review on reliability and validity

Langeveld M, et al. · *Skin research and technology : official journal of International Society for Bioengineering and the Skin (ISBS) [and] International Society for Digital Imaging of Skin (ISDIS) [and] International Society for Skin Imaging (ISSI)*, 2022 · <https://doi.org/10.1111/srt.13113> · P034

FOUND Across the systematic review, skin texture was assessed in only two studies (72 subjects, three devices), with PRIMOS the sole device showing excellent intra- and interobserver reliability.

WE TOOK Flags a thin evidence base (2 studies / 72 subjects) for objective texture devices; PRIMOS is the reference instrument, but none reached construct validity, tempering how hard noova anchors absolute roughness.

39 Collagen study advances for photoaging skin

Liu H, et al. · *Photodermatology, photoimmunology & photomedicine*, 2024 · <https://doi.org/10.1111/phpp.12931> · P035

FOUND Type I collagen makes up 80%-90% of skin collagen, type III 8%-12%, and type V 5%, and this matrix fragments and degrades with photoaging.

WE TOOK Explains the structural driver of surface texture loss (collagen fragmentation); camera reads the resulting roughness/wrinkles, not collagen composition itself.

40 Cosmeceuticals in photoaging: A review

Chan LKW, et al. · *Skin research and technology : official journal of International Society for Bioengineering and the Skin (ISBS) [and] International Society for Digital Imaging of Skin (ISDIS) [and] International Society for Skin Imaging (ISSI)*, 2024 · <https://doi.org/10.1111/srt.13730> · P036

FOUND In this systematic review, cosmeceutical evidence for photodamaged skin ranged from Level I to Level II, with peptides strongest at Level Ib.

WE TOOK Grades strength of topical evidence for reversing textural photodamage; informs how confidently noova can recommend texture-targeting cosmeceuticals (peptides best-supported).

41 Use of platelet rich plasma for skin rejuvenation

Phoebe LKW, et al. · *Skin research and technology : official journal of International Society for Bioengineering and the Skin (ISBS) [and] International Society for Digital Imaging of Skin (ISDIS) [and] International Society for Skin Imaging (ISSI)*, 2024 · <https://doi.org/10.1111/srt.13714> · P037

FOUND PRP treatment produced significant enhancements in facial parameters including pore size, texture, and wrinkles after one to three sessions.

WE TOOK Supports pore-size and texture as responsive, camera-readable outcomes; the 1-3 session dose frames expected timelines for texture-improvement nudges.

42 Sunscreens and Photoaging: A Review of Current Literature

Guan LL, et al. · *American journal of clinical dermatology*, 2021 · <https://doi.org/10.1007/s40257-021-00632-5> · P038

FOUND There is a paucity of US FDA-approved filters protecting against long UVA (>370 nm) and none against visible light, both implicated in photoaging.

WE TOOK Coverage gap above 370 nm means sunscreen may under-protect against texture/wrinkle photoaging; relevant to product-match guidance, not directly camera-readable.

43 Development and Validation of Photo-Numerical Scales for Facial Wrinkles on Chinese Population

Zhao X, et al. · *Journal of cosmetic dermatology*, 2025 · <https://doi.org/10.1111/jocd.70451> · P039

FOUND Photo-numeric wrinkle grading scores correlated with Primos 3D metrics at $r = 0.79$ for wrinkle volume and $r = 0.82$ for wrinkle depth, with intra-grader ICC > 0.9 and inter-grader ICC > 0.8.

WE TOOK Directly ties a camera-readable photonumeric wrinkle scale to objective 3D depth/volume roughness ($r \sim 0.8$), anchoring how a phone image maps to true wrinkle geometry.

44 Reliability and validity of two in vivo measurements for skin surface topography in aged adults

Trojahn C, et al. · *Skin research and technology : official journal of International Society for Bioengineering and the Skin (ISBS) [and] International Society for Digital Imaging of Skin (ISDIS) [and] International Society for Skin Imaging (ISSI)*, 2015 · <https://doi.org/10.1111/srt.12156> · P040

FOUND In vivo skin-roughness reliability spanned ICC 0.50-0.95 for Visioscan and 0.01-1.00 for PRIMOS, with Rmax, Rz, and Ra recommended as the most reliable topography parameters.

WE TOOK Shows lab profilometry roughness (Ra/Rz) reliability is parameter-dependent and can be poor; a consumer camera cannot resolve these micro-roughness metrics, so texture must be inferred, not measured.

45 The wrinkle severity rating scale: a validation study

Day DJ, et al. · *American journal of clinical dermatology*, 2004 · <https://doi.org/10.2165/00128071-200405010-00007> · P041

FOUND The Wrinkle Severity Rating Scale showed weighted kappa of 0.77 (left) and 0.81 (right) for intra-observer nasolabial-fold grading, with test-retest agreement of 68.7% and 72.7%.

WE TOOK Validated 5-grade wrinkle scale with substantial kappa reliability; a reference anchor for defining discrete fine-line/fold severity buckets in noova's texture scoring.

46 Clinical evaluation of skin aging: a systematic review

Wang YC, et al. · *Archives of gerontology and geriatrics*, 2025 · <https://doi.org/10.1016/j.archger.2025.105995> · P042

FOUND A systematic review of skin-aging scales included 42 publications and 47 scales: 20 for lines/wrinkles, 12 for sagging/volume, 6 for texture and quality, and 9 for global assessment.

WE TOOK Maps the validated-scale landscape and shows texture/quality has only 6 scales vs 20 for wrinkles, flagging where camera-readable, validated texture anchors are scarce.

47 Development and Validation of a Photonumeric Scale for Evaluation of Lip Fullness

Bloom J, et al. · *Journal of drugs in dermatology : JDD*, 2023 · <https://doi.org/10.36849/jdd.7309> · P043

FOUND The Merz Lip Fullness Assessment Scale reached near-perfect intrarater agreement with median weighted kappa of 0.911 (upper lip) and 0.930 (lower lip), all kappas ≥ 0.6 .

WE TOOK Demonstrates the kappa reliability ceiling (~ 0.9) achievable for a well-defined 5-point photonumeric facial scale; a methodological benchmark for noova's texture rating buckets.

48 Facial Laxity Rating Scale Validation Study

Leal Silva HG, et al. · *Dermatologic surgery : official publication for American Society for Dermatologic Surgery [et al.]*, 2016 · <https://doi.org/10.1097/dss.0000000000000915> · P044

FOUND The Facial Laxity Rating scale had combined weighted-kappa inter-rater agreement of 0.77 (95% CI 0.76-0.78) across 188 ratings, with 92.53% agreement to the truth standard.

WE TOOK Kappa ~ 0.77 for a trained-rater facial surface scale sets a realistic inter-rater reliability target that an automated texture/laxity classifier should aim to match.

49 Clinical Trial of Salmon Nasal Cartilage-Derived Proteoglycans on Human Facial Antiaging: A Randomized, Double-Blind, Placebo-Controlled Study

Bai XD, et al. · *Journal of cosmetic dermatology*, 2025 · <https://doi.org/10.1111/jocd.70218> · P045

FOUND In a 56-day RCT (n=66), oral 20 mg salmon proteoglycan produced significant reductions in skin roughness and wrinkles ($p < 0.001$) versus placebo.

WE TOOK Placebo-controlled evidence that measured roughness is a sensitive, movable texture endpoint over 8 weeks, supporting roughness as a trackable texture signal in noova.

50 Efficacy of combined treatment with human adipose tissue stem cell-derived exosome-containing solution and microneedling for facial skin aging: A 12-week prospective, randomized, split-face study

Park GH, et al. · *Journal of cosmetic dermatology*, 2023 · <https://doi.org/10.1111/jocd.15872> · P046

FOUND In a split-face RCT (n=28), the exosome-plus-microneedling side scored significantly higher on the Global Aesthetic Improvement Scale than control ($p = 0.005$), with PRIMOS-confirmed wrinkle gains.

WE TOOK Uses PRIMOS to quantify wrinkle/texture change in a controlled split-face design; reinforces that instrument-grade wrinkle metrics are the ground truth camera scoring approximates.

51 Low-molecular-weight collagen peptides supplement promotes a healthy skin: A randomized, double-blinded, placebo-controlled study

Seong SH, et al. · *Journal of cosmetic dermatology*, 2024 · <https://doi.org/10.1111/jocd.16026> · P047

FOUND In a placebo-controlled RCT of 100 participants, collagen peptides significantly improved average skin roughness and peak-to-valley wrinkle metrics versus placebo by Week 12.

WE TOOK Adds RCT support that average roughness and peak-to-valley wrinkle depth are responsive texture endpoints, useful as target metrics behind noova's texture score.

52 "The efficacy and adverse effects of treatment options for facial pores: A review article"

Parvar SY, et al. · *Journal of cosmetic dermatology*, 2023 · <https://doi.org/10.1111/jocd.15502> · P049

FOUND A review of 19 clinical trials pooled 591 cases (83.7% female) aged 18-80 years evaluating treatments that reduce facial pores driven by sebum.

WE TOOK High sebum excretion drives visible pores; supports treating enlarged pores as a camera-readable proxy for oil and calibrating focus by age (sebum control young vs rejuvenation older).

53 Facial Pores: Definition, Causes, and Treatment Options

Lee SJ, et al. · *Dermatologic surgery : official publication for American Society for Dermatologic Surgery [et al.]*, 2016 · <https://doi.org/10.1097/dss.0000000000000657> · P051

FOUND There are 3 major clinical causes of enlarged facial pores: high sebum excretion, decreased peri-pore elasticity, and increased hair follicle volume.

WE TOOK High sebum excretion is one of only three enlarged-pore drivers, so a camera reading enlarged pores partially indexes oil but must be disambiguated from elasticity/follicle causes.

How sebum behaves by age, zone and skin type — and why visible shine is not a sebum measurement.

54 Current Insights on Lipidomics in Dermatology: A Systematic Review

Sanabria-de la Torre R, et al. · *The Journal of investigative dermatology*, 2025 · <https://doi.org/10.1016/j.jid.2024.09.003> · P048

FOUND A PRISMA systematic review screened 1013 references and included 48 studies covering 2651 participants with a mean age of 34.13 ± 16.28 years.

WE TOOK Establishes sebutape/skin-surface lipidomics as the dominant in-vivo sebum sampling method and gives a pooled evidence base + age anchor for oil-signal literature.

55 Skin care and rejuvenation by cosmeceutical facial mask

Nilforoushzadeh MA, et al. · *Journal of cosmetic dermatology*, 2018 · <https://doi.org/10.1111/jocd.12730> · P050

FOUND Facial masks used to remove sebum fall into four categories: sheet, peel-off, rinse-off, and hydrogel masks.

WE TOOK Weak/categorical: informs the product-side of oil balance (masks physically remove surface sebum) rather than a measurable sebum value.

56 [The sebaceous gland]

Zouboulis CC, et al. · *Der Hautarzt; Zeitschrift für Dermatologie, Venerologie, und verwandte Gebiete*, 2010 · <https://doi.org/10.1007/s00105-009-1894-y> · P052

FOUND Sebum excretion rises with adrenarche at about age 9 years and continues climbing to the adult level by age 17 years.

WE TOOK Gives the age window (9-17) over which sebum output ramps to adult levels — direct anchor for age-calibrating oil-balance expectations rather than flagging teens as anomalous.

57 Can sebum reduction predict acne outcome?

Janiczek-Dolphin N, et al. · *The British journal of dermatology*, 2010 · <https://doi.org/10.1111/j.1365-2133.2010.09878.x> · P053

FOUND Pooled across treatments, a 30% to 50% reduction in sebum excretion was projected to achieve a 50% reduction in acne measures (slopes significant, $P < 0.025$).

WE TOOK Quantifies the sebum-to-acne dose relationship, justifying oil as a meaningful upstream signal: moderate sebum shifts (30-50%) map to large clinical acne change.

58 Acne and sebaceous gland function

Zouboulis CC, et al. · *Clinics in dermatology*, 2004 · <https://doi.org/10.1016/j.clindermatol.2004.03.004> · P054

FOUND Sebum excretion undergoes a new rise at about age 9 years with adrenarche and reaches adult levels by age 17 years.

WE TOOK Corroborates the 9-17 year sebum ramp and ties elevated sebum excretion to adolescent acne — supports age-band priors in oil scoring.

59 The effect of 2% niacinamide on facial sebum production

Draelos ZD, et al. · *Journal of cosmetic and laser therapy : official publication of the European Society for Laser Dermatology*, 2006 · <https://doi.org/10.1080/14764170600717704> · P055

FOUND In an RCT, topical 2% niacinamide significantly reduced casual sebum level (CSL) after 6 weeks in Caucasians, while sebum excretion rate (SER) was not significantly reduced.

WE TOOK Shows CSL and SER are distinct measurable oil endpoints that respond differently by ethnicity/ingredient — the camera reads casual sebum level (surface shine), not secretion rate.

60 High-Resolution Spatial Map of the Human Facial Sebaceous Gland Reveals Marker Genes and Decodes Sebocyte Differentiation

Düz T, et al. · *The Journal of investigative dermatology*, 2026 · <https://doi.org/10.1016/j.jid.2025.04.041> · P056

FOUND Spatial transcriptomics of the human facial sebaceous gland identified 4 distinct stages of sebocyte differentiation, each with unique gene signatures.

WE TOOK Weak/structural: documents human (not mouse) sebaceous-gland biology underlying sebum output; background support for oil, not a surface-measurable value.

61 Biometric Evaluation of Baumann Skin Typing

Delavar S, et al. · *Skin research and technology : official journal of International Society for Bioengineering and the Skin (ISBS) [and] International Society for Digital Imaging of Skin (ISDIS) [and] International Society for Skin Imaging (ISSI)*, 2026 · <https://doi.org/10.1111/srt.70338> · P057

FOUND In 71 volunteers, the Baumann oily-vs-dry questionnaire score correlated only weakly (though significantly) with measured sebum ($r = 0.299$, $p = 0.011$), while hydration and TEWL did not.

WE TOOK Critical calibration point: self-report/questionnaire oily-vs-dry typing tracks objective sebum only weakly ($r=0.30$), so noova's oil signal needs objective (camera/sebumeter) grounding, not questionnaire alone.

62 The Efficacy and Safety of Chitosan on Facial Skin Sebum

Theerawattanawit C, et al. · *Skin pharmacology and physiology*, 2022 · <https://doi.org/10.1159/000517965> · P059

FOUND Chitosan nanoparticle gel lowered T-zone sebum below placebo at week 4 ($p = 0.043$), with no difference in the U-zone.

WE TOOK Reinforces T-zone vs U-zone regional sebum separation for facial-region calibration; only the T-zone moved significantly, supporting region-weighted oil scoring.

63 Development and validation of a prospective questionnaire for assessing oily sensitive skin

Zhang J, et al. · *International journal of cosmetic science*, 2024 · <https://doi.org/10.1111/ics.12946> · P060

FOUND In 1297 subjects, ROC-derived oily-skin cut-offs of 22.5 and 31.5 distinguish moderately and severely oily skin, with sebum levels differing significantly across the three oily groups.

WE TOOK Provides validated oiliness severity thresholds (moderate vs severe) tied to significantly different measured sebum, useful as tiering anchors for a self-reported/camera-inferred oil scale.

64 Facial skin characteristics and concerns in Indonesia: A cross-sectional observational study

Du Y, et al. · *Skin research and technology : official journal of International Society for Bioengineering and the Skin (ISBS) [and] International Society for Digital Imaging of Skin (ISDIS) [and] International Society for Skin Imaging (ISSI)*, 2022 · <https://doi.org/10.1111/srt.13189> · P061

FOUND Across 419 Indonesian females, facial sebum stayed similar up to age 50 then declined in the 50-60 age band.

WE TOOK Age-calibration anchor: sebum is roughly flat through the 20s-40s and drops only after 50, so age should shift expected-sebum baselines mainly at older ages.

65 Sebum excretion in hidradenitis suppurativa

Jemec GB, et al. · *Dermatology (Basel, Switzerland)*, 1997 · <https://doi.org/10.1159/000246125> · P062

FOUND Sebum excretion and active-gland counts followed a strong regional gradient of face > axillae/genitofemoral fold ($p < 0.0001$) in both patients and controls.

WE TOOK Quantifies that the face is the highest-sebum region body-wide, justifying facial-region weighting and that hidradenitis (non-facial) does not elevate facial sebum.

66 Effect of antihistamine as an adjuvant treatment of isotretinoin in acne: a randomized, controlled comparative study

Lee HE, et al. · *Journal of the European Academy of Dermatology and Venereology : JEADV*, 2014 · <https://doi.org/10.1111/jdv.12403> · P063

FOUND Adding antihistamine to isotretinoin cut total acne lesions 45.6% vs 18.7% at week 12, alongside a significant reduction in measured sebum.

WE TOOK Links measured sebum reduction to lesion clearance, supporting sebum as an upstream driver of acne severity in oil-balance scoring.

67 Skin Anti-Aging and Moisturizing Effects of Low-Molecular-Weight Collagen Peptide Supplementation in Healthy Adults: A Randomized, Double-Blind, Placebo-Controlled Clinical Trial

Lee E, et al. · *Journal of microbiology and biotechnology*, 2025 · <https://doi.org/10.4014/jmb.2507.07008> · P064

FOUND In 70 adults, oral collagen peptide at 1,650 mg/day for 8 weeks produced decreased sebum secretion and pore-tightening effects.

WE TOOK Evidence that sebum and pore size covary and both respond to an intervention, supporting a coupled pore/oil sub-signal in scoring.

Erythema grading, and the critical confound: melanin interferes with reading redness.

68 Transcutaneous Auricular Vagus Nerve Stimulation Treatment for Erythematotelangiectatic Rosacea: A Randomized Clinical Trial

Li J, et al. · *JAMA dermatology*, 2025 · <https://doi.org/10.1001/jamadermatol.2025.3796> · P065

FOUND In an RCT, mean CEA score at 3 weeks was 1.56 (SD 0.84) with taVNS vs 2.47 (SD 0.81) with sham (mean difference -0.92; 95% CI -1.3 to -0.53; $P < .001$).

WE TOOK Anchors the CEA 0-4 grading scale numerically and shows a ~0.9-point CEA change is a clinically meaningful erythema shift for calibrating noova's redness deltas.

69 Meta-Analysis of the Efficacy of Intense Pulsed Light and Pulsed-Dye Laser Therapy in the Management of Rosacea

Zhai Q, et al. · *Journal of cosmetic dermatology*, 2024 · <https://doi.org/10.1111/jocd.16549> · P066

FOUND Across 4 studies (141 participants), change in erythema index did not differ between IPL and PDL (SMD = -0.15, 95% CI: -0.55 to 0.26).

WE TOOK Confirms erythema index is a standard pooled outcome for rosacea severity, supporting index-style redness readouts, though camera-based indices differ from clinical devices.

70 Incidence and prevalence of rosacea: a systematic review and meta-analysis

Gether L, et al. · *The British journal of dermatology*, 2018 · <https://doi.org/10.1111/bjd.16481> · P067

FOUND Pooled rosacea prevalence was 5.46% (95% CI 4.91-6.04) in the general population and 2.39% (95% CI 1.56-3.39) among dermatology outpatients.

WE TOOK Base-rate prior for how often facial erythema/rosacea appears in a general population, useful for setting expected distribution of redness scores.

71 Treatment of ocular rosacea: a systematic review

Avraham S, et al. · *Journal der Deutschen Dermatologischen Gesellschaft = Journal of the German Society of Dermatology : JDDG*, 2024 · <https://doi.org/10.1111/ddg.15290> · P068

FOUND In 1,275 patients, topical antimicrobials and oral antibiotics achieved complete or partial response in 91% (82/90) and 89% (525/580) of patients respectively.

WE TOOK Quantifies treatment-response rates for rosacea, informing how much calming/erythema improvement noova should expect after intervention for its redness-trend messaging.

72 The role of vitamins and nutrients in rosacea

Algarin YA, et al. · *Archives of dermatological research*, 2024 · <https://doi.org/10.1007/s00403-024-02895-4> · P069

FOUND Oral isotretinoin produced a 90% reduction in lesions, complete remission in 24% of patients, and marked improvement in 57% of patients.

WE TOOK Effect-size anchors for redness/lesion improvement magnitudes, useful for calibrating what constitutes large vs modest calming in noova's redness deltas.

73 Rosacea management: A comprehensive review

Sharma A, et al. · *Journal of cosmetic dermatology*, 2022 · <https://doi.org/10.1111/jocd.14816> · P070

FOUND Rosacea affects up to 10% of the world population, especially fair-skinned individuals aged 35-50.

WE TOOK Prevalence ceiling and demographic (fair skin) note; relevant because camera erythema reads differ by baseline skin tone and age band.

74 Signaling pathways and targeted therapy for rosacea

Yang F, et al. · *Frontiers in immunology*, 2024 · <https://doi.org/10.3389/fimmu.2024.1367994> · P071

FOUND Rosacea has a reported global prevalence ranging from 1% to 20%.

WE TOOK Wide prevalence range documents how much erythema base-rate varies by population, cautioning against a single fixed redness threshold across cohorts.

75 Outcome measurement instruments for erythema associated with incontinence-associated dermatitis: Systematic review

De Meyer D, et al. · *Journal of advanced nursing*, 2019 · <https://doi.org/10.1111/jan.14102> · P072

FOUND Of 14 studies covering 10 erythema instruments for incontinence-associated dermatitis, the most-studied measurement properties were reliability (9 studies), measurement error (4 studies), and criterion validity (4 studies).

WE TOOK Shows erythema measurement instruments are validated mainly on reliability, flagging that redness grading tools need explicit reliability/measurement-error evidence.

76 Neurogenic Rosacea Treatment: A Literature Review

Ivanic MG, et al. · *Journal of drugs in dermatology : JDD*, 2023 · <https://doi.org/10.36849/jdd.7181> · P073

FOUND A systematic search identified 6 articles with a total of 37 patients with suspected neurogenic rosacea.

WE TOOK Small evidence base for the flushing/erythema-dominant neurogenic subtype, a reminder that some erythema presentations are under-characterized clinically.

77 Treatment management for rosacea: current pharmacological and non-pharmacological options

Volk K, et al. · *Expert review of clinical pharmacology*, 2025 · <https://doi.org/10.1080/17512433.2025.2550727> · P074

FOUND Rosacea is classified into four subtypes: erythematotelangiectatic, papulopustular, phymatous, and ocular involvement.

WE TOOK Defines the four-subtype framework so a redness signal can be mapped to the erythematotelangiectatic subtype that a camera reads most directly.

78 Reliability of Clinician Erythema Assessment grading scale

Tan J, et al. · *Journal of the American Academy of Dermatology*, 2014 · <https://doi.org/10.1016/j.jaad.2014.05.044> · P075

FOUND The Clinician's Erythema Assessment 5-point scale had an overall intraclass correlation coefficient of 0.601 (session 1) and 0.576 (session 2), with an overall weighted kappa of 0.692.

WE TOOK CEA is the clinical 5-point erythema anchor; ICC ~0.58-0.60 among trained dermatologists sets a realistic reliability ceiling that noova's redness score can be benchmarked against.

79 Reliability of a Skin Diagnostic Device in Assessing Hydration and Erythema

Huimin K, et al. · *Advances in skin & wound care*, 2017 · <https://doi.org/10.1097/01.asw.0000520117.58976.32> · P076

FOUND The SD202 skin diagnostic device showed high internal consistency for consecutive erythema measures at a single venous leg ulcer periwound point (Cronbach alpha > .970).

WE TOOK Instrument-based erythema reads (SD202) reach very high repeatability (alpha > .97), a device benchmark for noova's redness read, though the abstract notes consistency dropped in predebridement measures.

80 Evaluation of different factors influencing objective measurement of skin color by colorimetry

Anbar TS, et al. · *Skin research and technology : official journal of International Society for Bioengineering and the Skin (ISBS) [and] International Society for Digital Imaging of Skin (ISDIS) [and] International Society for Skin Imaging (ISSI)*, 2019 · <https://doi.org/10.1111/srt.12680> · P077

FOUND Incomplete device-skin contact significantly lowered the erythema index ($P < 0.001$) while high applied pressure significantly raised it ($P < 0.001$) on colorimetric measurement.

WE TOOK Erythema-index reads are strongly confounded by device contact and pressure ($P < 0.001$); a camera-based redness read must control geometry/contact-equivalent artifacts and cannot assume EI is pressure-invariant.

81 Validation of a neonatal skin color scale

Maya-Enero S, et al. · *European journal of pediatrics*, 2020 · <https://doi.org/10.1007/s00431-020-03623-6> · P087

FOUND A neonatal skin-color scale validated against the Mexameter MX 18 achieved 83.2% inter-observer agreement, with only melanin (not erythema) differing significantly across color groups.

WE TOOK Shows Mexameter melanin index cleanly separates tone categories independent of erythema, validating melanin-index as the anchor for tone (not redness) in evenness scoring.

Measuring evenness within a person's own tone — never lightness — and cross-device reliability limits.

82 Laser therapy in the treatment of melasma: a systematic review and meta-analysis

Lai D, et al. · *Lasers in medical science*, 2022 · <https://doi.org/10.1007/s10103-022-03514-2> · P078

FOUND Low-fluence Q-switched 1,064-nm Nd:YAG laser reduced MASI with a weighted mean difference of -2.76 (95% CI: -3.53 to -1.99).

WE TOOK Gives MASI effect-size anchors (WMD) for pigment-lesion change; MASI is a clinician grader, not a camera read, useful for calibrating the expected magnitude of a real evenness shift.

83 Efficacy and Safety of Tranexamic Acid in Melasma: A Meta-analysis and Systematic Review

Kim HJ, et al. · *Acta dermato-venereologica*, 2017 · <https://doi.org/10.2340/00015555-2668> · P079

FOUND Tranexamic acid alone lowered MASI by 1.60 (95% CI 1.20-2.00; $p < 0.001$).

WE TOOK Quantifies a ~1.6-point MASI drop as a clinically meaningful pigment change, anchoring what counts as a real evenness improvement versus measurement noise.

84 Comparison of the Efficacy of Melasma Treatments: A Network Meta-Analysis of Randomized Controlled Trials

Liu Y, et al. · *Frontiers in medicine*, 2021 · <https://doi.org/10.3389/fmed.2021.713554> · P080

FOUND Across melasma therapies, side-effect rates ranged from 10.1% (tretinoin) to 52.3% (microneedles).

WE TOOK MASI-based ranking plus side-effect percentages across 14 therapies gives a comparative pigment-treatment reference, with MASI as the common evenness outcome metric.

85 The clinical effect of glutathione on skin color and other related skin conditions: A systematic review

Dilokthornsakul W, et al. · *Journal of cosmetic dermatology*, 2019 · <https://doi.org/10.1111/jocd.12910> · P081

FOUND Oral glutathione 500 mg/day and topical 2.0% oxidized glutathione brightened sun-exposed skin as measured by melanin index.

WE TOOK Directly validates melanin index (Mexameter-style) as a measurable brightening signal, and that change appears in sun-exposed (uneven) areas, reinforcing within-tone evenness rather than melanin-depth framing.

86 Chemical Peels for Melasma: A Systematic Review

Sarkar R, et al. · *Dermatologic surgery : official publication for American Society for Dermatologic Surgery [et al.]*, 2024 · <https://doi.org/10.1097/dss.0000000000004167> · P082

FOUND A review of 24 studies (15 RCTs) with a total sample of 1,075 patients quantified chemical-peel efficacy in melasma using MASI.

WE TOOK Confirms MASI as the standard pigment-grading outcome across a 1,075-patient evidence base, supporting MASI as the reference scale for melasma evenness.

87 Topical treatment for postinflammatory hyperpigmentation: a systematic review

Tan MG, et al. · *The Journal of dermatological treatment*, 2022 · <https://doi.org/10.1080/09546634.2021.1981814> · P083

FOUND A PIH systematic review included 47 of 1,224 screened studies covering 1,853 subjects.

WE TOOK Anchors the post-inflammatory hyperpigmentation evidence base and notes inflammation is subtle in darker phototypes, a caution that cameras may miss early uneven pigment in deep tones.

88 Topical and Systemic Therapies in Melasma: A Systematic Review

Sarkar R, et al. · *Indian dermatology online journal*, 2023 · https://doi.org/10.4103/idoj.idoj_490_22 · P084

FOUND A PRISMA melasma review identified 174 randomized/controlled trials grading hydroquinone, triple-combination cream, sunscreens, kojic and azelaic acid as grade A.

WE TOOK Large evidence map of pigment therapies with grade-A recommendations, supporting an evidence-backed catalogue of evenness treatments to surface.

89 Characteristics and management of Asian skin

Chan IL, et al. · *International journal of dermatology*, 2019 · <https://doi.org/10.1111/ijd.14153> · P085

FOUND Asian skin spans Fitzpatrick types III to IV (Chinese, Japanese) to IV and V (Indian, Pakistani).

WE TOOK Fitzpatrick III-V reference mapping across subgroups supports fair within-tone scoring across deep phototypes; the paper also notes melanocyte number is similar across types, reinforcing never penalizing melanin depth.

90 Clinical Validation of Imaging Biomarkers in Mycosis Fungoides

Wind SS, et al. · *Experimental dermatology*, 2026 · <https://doi.org/10.1111/exd.70236> · P086

FOUND MSI individual typology angle (ITA) and companion imaging biomarkers showed strong test-retest reliability with CV < 10% and ICC > 0.84 while discriminating lesional from non-lesional skin at $p \leq 0.001$.

WE TOOK Anchors ITA as a repeatable, camera-readable pigmentation biomarker (ICC > 0.84, CV < 10%), supporting ITA-based within-tone evenness scoring in noova.

91 Clinical Evaluation of Thiamidol-Containing Formulations for the Visual Management of Facial Hyperpigmentation

Desai SR, et al. · *Journal of drugs in dermatology : JDD*, 2025 · <https://doi.org/10.36849/jdd.9517> · P088

FOUND In 90 subjects (n=43 serum; n=47 regimen), Thiamidol formulations produced significant increases in L* and ITA° values as early as week 2, with continued improvement through week 12.

WE TOOK Confirms ITA° (with L*) as a sensitive colorimetric readout of hyperpigmentation change over weeks, supporting ITA as a longitudinal evenness signal noova can track.

92 The efficacy and safety of microneedling with topical tranexamic acid for melasma treatment: A systematic review and meta-analysis

Feng X, et al. · *Journal of cosmetic dermatology*, 2024 · <https://doi.org/10.1111/jocd.15965> · P089

FOUND Pooled microneedling-plus-topical-TXA reduced MASI/mMASI/hemiMASI vs baseline with MD = 1.85 (4 wk), 3.28 (8 wk), and 4.73 (12 wk).

WE TOOK Provides MASI change magnitudes (MD ~1.8-4.7) that calibrate what a clinically meaningful pigment-evenness improvement looks like on the MASI scale.

93 Efficacy and safety of laser-related therapy for melasma: A systematic review and network meta-analysis

Ma W, et al. · *Journal of cosmetic dermatology*, 2023 · <https://doi.org/10.1111/jocd.16006> · P090

FOUND Network meta-analysis of 39 studies (1394 participants) found QSND+topical medications superior to QSND alone by MD = -4.21 (-6.80, -1.63) on MASI.

WE TOOK Quantifies between-treatment MASI differences (MD ~-3.5 to -4.2), anchoring the resolution at which MASI distinguishes pigment outcomes.

94 Application of PRP in Chloasma: A Meta-Analysis and Systematic Review

Deng T, et al. · *Computational intelligence and neuroscience*, 2022 · <https://doi.org/10.1155/2022/7487452> · P091

FOUND Intradermal PRP for chloasma significantly decreased MASI (mean -6.71, 95% CI -8.99 to -4.33) and mMASI (mean -2.94, 95% CI -4.81 to -1.07).

WE TOOK Gives paired MASI (-6.71) vs mMASI (-2.94) effect sizes, useful for mapping raw vs modified MASI scale magnitudes in pigment-evenness scoring.

95 Efficacy of Botulinum Toxin A for the Management of Melasma: A Split-Face, Randomized Control Study

Chaijaras S, et al. · *Journal of cosmetic dermatology*, 2025 · <https://doi.org/10.1111/jocd.70376> · P092

FOUND In a split-face RCT, week-24 MASIm was 14.79 (21.03% worse) on monotherapy vs 9.14 (36.97% improvement, $p = 0.0003$) on the BoNT-A combination side.

WE TOOK Split-face MASIm plus colorimeter melanin index gives paired within-subject percent-change anchors (36.97% vs -21.03%) for pigment scoring calibration.

96 Tranexamic acid as a therapeutic option for melasma management: meta-analysis and systematic review of randomized controlled trials

Calacattawi R, et al. · *The Journal of dermatological treatment*, 2024 · <https://doi.org/10.1080/09546634.2024.2361106> · P093

FOUND A meta-analysis of 22 studies with 1280 patients found TXA significantly reduced MASI, mMASI, MI, and hemi-MASI scores.

WE TOOK Large pooled evidence base (1280 patients) confirming MASI/mMASI/MI as convergent pigment-severity endpoints noova can lean on.

97 Comparative Efficacy and Safety of Injectable Tranexamic Acid Combination Therapies for Melasma: A Network Meta-analysis of Randomized Controlled Trials

Nukaly H, et al. · *Aesthetic surgery journal*, 2025 · <https://doi.org/10.1093/asj/sjaf097> · P094

FOUND A network meta-analysis of 9 RCTs (358 participants) found TXA + 4% hydroquinone gave the largest MASI improvement of the compared interventions.

WE TOOK MASI-scored comparative evidence (358 participants) reinforcing MASI as the standard pigment-severity outcome for evenness benchmarking.

98 Glutathione as an oral whitening agent: a randomized, double-blind, placebo-controlled study

Arjinpathana N, et al. · *The Journal of dermatological treatment*, 2012 · <https://doi.org/10.3109/09546631003801619> · P095

FOUND Oral glutathione 500 mg/day for 4 weeks lowered melanin index significantly more than placebo at two of six sites ($p = 0.021$ and 0.036).

WE TOOK Demonstrates melanin index sensitivity to modest, site-specific pigment change, reminding that melanin depth shifts are measurable but should never be penalized as unevenness.

99 Microneedling as an adjuvant to topical therapies for melasma: A systematic review and meta-analysis

Bailey AJM, et al. · *Journal of the American Academy of Dermatology*, 2022 · <https://doi.org/10.1016/j.jaad.2021.03.116> · P111

FOUND Adding microneedling to topical therapies (including vitamin C) improved melasma severity with a large effect ($SMD > 0.8$) beyond 8 weeks.

WE TOOK Informs vitamin C/topical melasma %-match; microneedling-assisted topicals reach a large effect ($SMD > 0.8$) on pigmentation by 12 weeks.

100 Comparative Efficacy of 35 % Glycolic Acid Peel versus 4 % Retinol Peel in Melasma

Rini T, et al. · *Dermatologic surgery : official publication for American Society for Dermatologic Surgery [et al.]*, 2026 · <https://doi.org/10.1097/dss.0000000000004858> · P112

FOUND In melasma, mild self-limiting adverse effects were more common with 4% retinol peel (13.3%) than 35% glycolic acid peel (3.3%), with both peels comparably effective.

WE TOOK Grades AHA (glycolic) vs retinol peel %-match for melasma; comparable efficacy with glycolic better tolerated (3.3% vs 13.3% AEs).

101 Evaluation of the Efficacy of a Serum Containing Niacinamide, Tranexamic Acid, Vitamin C, and Hydroxy Acid Compared to 4% Hydroquinone in the Management of Melasma

Rocio J, et al. · *Journal of cosmetic dermatology*, 2025 · <https://doi.org/10.1111/jocd.70097> · P113

FOUND A niacinamide/tranexamic-acid/vitamin C serum significantly reduced melasma pigmentation ($p < 0.001$) after 3 months, with efficacy similar to 4% hydroquinone.

WE TOOK Strong niacinamide + vitamin C %-match for pigment: a multi-active serum matched 4% hydroquinone ($p < 0.001$) with better local tolerance.

102 Glutathione as a skin-lightening agent and in melasma: a systematic review

Sarkar R, et al. · *International journal of dermatology*, 2025 · <https://doi.org/10.1111/ijd.17535> · P122

FOUND Five RCTs plus one open-arm study of oral glutathione at 250-500 mg/day showed a significant reduction in the melanin index versus placebo.

WE TOOK Melanin-index reductions provide an objective pigmentation benchmark against which noova can calibrate its pigmentation/skin-tone-evenness scoring over time.

103 Efficacy of topical vitamin C in melasma and photoaging: A systematic review

Correia G, et al. · *Journal of cosmetic dermatology*, 2023 · <https://doi.org/10.1111/jocd.15748> · P123

FOUND A systematic review of seven publications (139 volunteers) found significant lightening of skin treated with topical vitamin C on objective pigmentation assessments.

WE TOOK Objective pigmentation-lightening evidence supports calibration of noova's overall pigmentation score for expected treatment-driven change.

Effect sizes for the actives we grade products on: retinoids, niacinamide, vitamin C, acids, ceramides, sunscreen.

104 The Effect of Local Hyaluronic Acid Injection on Skin Aging: A Systematic Review and Meta-Analysis

Zhou R, et al. · *Journal of cosmetic dermatology*, 2025 · <https://doi.org/10.1111/jocd.16760> · P096

FOUND Random-effects meta-analysis found hyaluronic acid injection significantly improved skin hydration (SMD = 1.34) and radiance (SMD = 0.51) versus controls.

WE TOOK Anchors a strong (large-effect) product-match for HA on the hydration/radiance signals; weaker/insignificant for elasticity, so grade HA highest for hydration.

105 Oral Hyaluronic Acid Supplement: Efficacy in Skin Hydration, Elasticity, and Wrinkle Depth Reduction

Amin P, et al. · *Journal of drugs in dermatology : JDD*, 2025 · <https://doi.org/10.36849/jdd.8542> · P097

FOUND A meta-analysis of 7 RCTs of oral hyaluronic acid showed statistically significant improvements in skin hydration, elasticity, and wrinkle depth.

WE TOOK Supports HA product-match on hydration/wrinkle signals with pooled RCT evidence, though non-significant for firmness and TEWL (moderate confidence).

106 Efficacy of topical treatments for mild-to-moderate acne: A systematic review and meta-analysis of randomized control trials

Kakpovbia EE, et al. · *Journal of the European Academy of Dermatology and Venereology : JEADV*, 2025 · <https://doi.org/10.1111/jdv.20154> · P098

FOUND In a network meta-analysis, adding clindamycin to tretinoin did not significantly improve non-inflammatory lesion reduction (RoM 1.13; 95% CI 0.94-1.36), so tretinoin drives the effect.

WE TOOK Grounds high product-match for adapalene/tretinoin combinations on acne/clarity; retinoid is the active component, so retinoid-containing acne products score strongly.

107 Comparing Tretinoin to Other Topical Therapies in the Treatment of Skin Photoaging: A Systematic Review

Siddiqui Z, et al. · *American journal of clinical dermatology*, 2024 · <https://doi.org/10.1007/s40257-024-00893-w> · P099

FOUND Across 23 comparison studies, comparators to tretinoin were equivalent in 13, greater in 7, and less effective in 3, confirming tretinoin as the gold-standard anti-aging benchmark.

WE TOOK Establishes tretinoin as the reference product-match for photoaging/wrinkles; retinol/retinaldehyde products grade near-equivalent with better tolerability.

108 Topical azelaic acid, salicylic acid, nicotinamide, sulphur, zinc and fruit acid (alpha-hydroxy acid) for acne

Liu H, et al. · *The Cochrane database of systematic reviews*, 2020 · <https://doi.org/10.1002/14651858.cd011368.pub2> · P100

FOUND In a Cochrane review, azelaic acid was slightly less effective than benzoyl peroxide (RR 0.82) but comparable to tretinoin (RR 0.94) for acne treatment response.

WE TOOK Grounds azelaic acid product-match for acne/clarity at roughly tretinoin-level efficacy; the review also covers salicylic acid and glycolic peels for the AHA/BHA signals.

109 Use of sunscreen and risk of melanoma and non-melanoma skin cancer: a systematic review and meta-analysis

Silva ESD, et al. · *European journal of dermatology : EJD*, 2018 · <https://doi.org/10.1684/ejd.2018.3251> · P101

FOUND A meta-analysis of 29 studies (313,717 participants) found no significant association between sunscreen use and skin cancer (OR 1.08; 95% CI 0.91-1.28).

WE TOOK Calibration caution for sunscreen product-match: observational data show no population-level protection signal, so avoid over-weighting SPF match on cancer-prevention grounds.

110 Comparative efficacy of topical interventions for facial photoaging: a network meta-analysis

Lin L, et al. · *Scientific reports*, 2025 · <https://doi.org/10.1038/s41598-025-12597-0> · P102

FOUND A network meta-analysis of 23 RCTs (3905 participants) ranked isotretinoin, retinol, and tretinoin as significantly improving fine wrinkles, with glycolic acid best for roughness.

WE TOOK Provides relative product-match ranking for photoaging: retinoids top for wrinkles/hyperpigmentation, glycolic acid for texture/roughness, informing signal-specific weighting.

111 Effect of Nicotinamide in Skin Cancer and Actinic Keratoses Chemoprophylaxis, and Adverse Effects Related to Nicotinamide: A Systematic Review and Meta-Analysis

Mainville L, et al. · *Journal of cutaneous medicine and surgery*, 2022 · <https://doi.org/10.1177/12034754221078201> · P104

FOUND Nicotinamide (niacinamide) reduced skin cancer incidence versus control with a rate ratio of 0.50 (95% CI 0.29-0.85) across 5 trials.

WE TOOK Supports niacinamide %-match; a ~50% relative reduction in skin cancers is a strong efficacy signal for niacinamide's protective/actinic value.

112 Interventions for photodamaged skin

Samuel M, et al. · *The Cochrane database of systematic reviews*, 2005 · <https://doi.org/10.1002/14651858.cd001782.pub2> · P105

FOUND Topical 0.05% tretinoin improved photodamaged skin versus placebo with a relative risk of improvement of 1.73 (95% CI 1.39-2.14) at 24 weeks.

WE TOOK Anchors retinoid %-match for photoaging/wrinkles; RR 1.73 improvement confirms strong topical tretinoin efficacy (topical ascorbic acid also showed benefit).

113 Topical supplementation with physiological lipids rebalances the stratum corneum ceramide profile and strengthens skin barrier function in adults predisposed to atopic dermatitis

Andrew PV, et al. · *The British journal of dermatology*, 2025 · <https://doi.org/10.1093/bjd/ljaf200> · P106

FOUND A topical multivesicular emulsion with physiological lipids significantly increased stratum corneum ceramide NP(18) by 24% and AP(18) by 19%.

WE TOOK Direct ceramide %-match evidence: a ceramide-lipid moisturizer measurably rebuilds SC ceramides (+24%/+19%) and improves barrier integrity.

114 Efficacy of combined 1927 nm thulium fiber laser and supramolecular salicylic acid in photoaging treatment

Qiao S, et al. · *Lasers in medical science*, 2025 · <https://doi.org/10.1007/s10103-025-04611-8> · P107

FOUND Adding 30% supramolecular salicylic acid to thulium laser reduced photoaging scores by 10.51% versus 7.26% for laser alone ($P < 0.001$).

WE TOOK Supports salicylic acid (BHA) %-match for photoaging; adjunct SSA adds a measurable ~3% extra photoaging-score reduction.

115 Barrier films or dressings for the prevention of acute radiation dermatitis in breast cancer: a systematic review and network meta-analysis

Wong HCY, et al. · *Breast cancer research and treatment*, 2024 · <https://doi.org/10.1007/s10549-024-07435-2> · P108

FOUND Barrier films/dressings reduced moist desquamation versus standard care: Hydrofilm OR=0.08, Mepitel Film OR=0.31, StrataXRT OR=0.22.

WE TOOK Barrier/occlusive product evidence: strong odds-ratio reductions (OR 0.08-0.31) inform %-match for barrier-protective formulations.

116 Skin care interventions in infants for preventing eczema and food allergy

Kelleher MM, et al. · *The Cochrane database of systematic reviews*, 2022 · <https://doi.org/10.1002/14651858.cd013534.pub3> · P110

FOUND Emollient skin-care in infancy did not reduce eczema risk (RR 1.03, 95% CI 0.81-1.31) and probably increased skin infection risk.

WE TOOK Caps %-match for emollients as eczema PREVENTION (null RR 1.03); barrier moisturizers don't prevent eczema in healthy infants.

117 The Impact of an AGE-Inhibiting Moisturizer on Procedure Effectiveness

Draeos ZD, et al. · *Journal of drugs in dermatology : JDD*, 2025 · <https://doi.org/10.36849/jdd.9201> · P115

FOUND After a glycolic acid peel, an AGE-inhibiting moisturizer beat control on 5 facial attributes (clarity, tone, fine lines, elasticity, overall appearance) at week 8 (all $P < 0.05$).

WE TOOK Post-peel adjunct moisturizer %-match; significant gains on 5 aging attributes ($P < 0.05$) support pairing glycolic (AHA) procedures with a barrier moisturizer.

The honesty layer: how much a selfie recovers versus clinical instruments, and why photo quality must gate the score.

118 Development and validation of neonatal jaundice detection using smartphone application

Shen GT, et al. · *Computers in biology and medicine*, 2025 · <https://doi.org/10.1016/j.compbimed.2025.110845> · P116

FOUND A smartphone jaundice model using a color-calibration card identified 89.4% of newborns with TsB>15 mg/dL at an AUC of 0.963, sensitivity 90.1% and specificity 89.0%.

WE TOOK Demonstrates that smartphone capture with an explicit color-calibration card reaches near-clinical accuracy, supporting noova's image-quality gating and standardized-capture requirements.

119 Man against machine: diagnostic performance of a deep learning convolutional neural network for dermoscopic melanoma recognition in comparison to 58 dermatologists

Haenssle HA, et al. · *Annals of oncology : official journal of the European Society for Medical Oncology*, 2018 · <https://doi.org/10.1093/annonc/mdy166> · P117

FOUND A CNN's ROC AUC exceeded the mean AUC of 58 dermatologists (0.86 versus 0.79, $P < 0.01$) for dermoscopic melanoma classification.

WE TOOK Benchmarks AI-vs-dermatologist agreement, informing how much confidence noova can assign to model-derived skin assessments relative to expert judgment.

120 Dermatologist-level classification of skin cancer with deep neural networks

Esteva A, et al. · *Nature*, 2017 · <https://doi.org/10.1038/nature21056> · P118

FOUND A single CNN trained on 129,450 clinical images spanning 2,032 diseases matched 21 board-certified dermatologists on skin-cancer classification.

WE TOOK Establishes the dataset scale needed for dermatologist-level image classification, a reference point for calibrating noova's model confidence and smartphone-delivered scoring.

121 Artificial intelligence in dermatology: advancements and challenges in skin of color

Fliorent R, et al. · *International journal of dermatology*, 2024 · <https://doi.org/10.1111/ijd.17076> · P119

FOUND Only 30% of the AI dermatology programs reviewed reported any data on their use in skin of color, and current programs performed worse at identifying lesions in skin of color.

WE TOOK Quantifies the skin-of-color evidence gap driving fairness guardrails, cautioning that noova's scores may be less reliable on darker skin tones without SOC validation.

122 Artificial intelligence for nonmelanoma skin cancer

Trager MH, et al. · *Clinics in dermatology*, 2024 · <https://doi.org/10.1016/j.clindermatol.2024.06.016> · P120

FOUND Only three of the reviewed publications addressed skin of color and AI for nonmelanoma skin cancer, flagging limited diverse training data.

WE TOOK Reinforces the scarcity of skin-of-color evidence, supporting noova's fairness guardrails and skepticism toward model generalizability across skin tones.

123 AI in Psoriatic Disease: Scoping Review

Barlow R, et al. · *JMIR dermatology*, 2024 · <https://doi.org/10.2196/50451> · P121

FOUND A scoping review of 38 papers found AI applied to psoriatic disease, including telermatology diagnosis from patient-taken photographs and severity estimation.

WE TOOK Confirms patient-captured photos can drive severity estimation, relevant to noova's image-based severity scoring while noting validation and skin-phototype generalizability limits.

124 Diagnostic reliability in telermatology: a systematic review and a meta-analysis

Bourkas AN, et al. · *BMJ open*, 2023 · <https://doi.org/10.1136/bmjopen-2022-068207> · P124

FOUND Across 44 studies, telermatology vs face-to-face pooled diagnostic agreement was 68.9% with kappa 0.67, rising to 71% (kappa 0.69) for dermatologists but only 44% (kappa 0.52) for non-specialists.

WE TOOK Anchors an expected image-based-vs-in-person agreement ceiling (~0.67 kappa) and shows rater expertise plus image-acquisition training swing accuracy sharply, informing noova's confidence gating.

125 Comparative and complementary diagnostic value of dermatoscopy and clinical close-up photography in skin cancer diagnosis: A study from the MILK10k dataset

Müller C, et al. · *Journal of the American Academy of Dermatology*, 2026 · <https://doi.org/10.1016/j.jaad.2026.03.069> · P125

FOUND In a 283-reader study on 1567 paired images, dermatoscopy alone had 85.0% sensitivity vs 74.2% for clinical close-ups, but lower specificity (66.8% vs 71.9%).

WE TOOK Quantifies the sensitivity/specificity tradeoff of consumer-style close-up photos vs dermatoscopy, calibrating how much diagnostic weight noova can place on a phone image lacking dermatoscopic detail.

126 Diagnostic Accuracy of Pediatric Telermatology Using Parent-Submitted Photographs: A Randomized Clinical Trial

O'Connor DM, et al. · *JAMA dermatology*, 2017 · <https://doi.org/10.1001/jamadermatol.2017.4280> · P126

FOUND Concordance between parent smartphone photos and in-person diagnosis rose to 89% (kappa 0.88) when photos were of high enough quality, vs 83% (kappa 0.81) overall.

WE TOOK Direct evidence that filtering to high-quality smartphone images materially lifts diagnostic concordance, supporting noova's image-quality gate before scoring.

127 Diagnostic Reliability of In-Person Versus Remote Dermatology: A Meta-Analysis

Bastola M, et al. · *Telemedicine journal and e-health : the official journal of the American Telemedicine Association*, 2021 · <https://doi.org/10.1089/tmj.2020.0043> · P127

FOUND Meta-analysis of six dual-in-person studies found remote diagnoses significantly less concordant than in-person (OR = 0.55, 95% CI 0.42-0.72, I² = 58%).

WE TOOK Establishes that remote/image-only assessment is systematically less reliable than in-person, a prior for capping noova's confidence on photo-only scans of risky lesions.

128 A longitudinal study of consistency in diagnostic accuracy of telermatology tools

Kanthraj GR, et al. · *Indian journal of dermatology, venereology and leprology*, 2013 · <https://doi.org/10.4103/0378-6323.116735> · P128

FOUND Aggregated over 15 years, store-and-forward telermatology averaged 73.35% +/- 14.87% diagnostic accuracy vs 70.37% +/- 7.01% for video, both stable against face-to-face gold standard.

WE TOOK Gives a stable long-run accuracy baseline (~73%) for asynchronous image-based diagnosis, useful for calibrating noova's expected agreement and confidence bands.

129 **Teledermatology and in-person examinations: a comparison of patient and physician perceptions and diagnostic agreement**

Lowitt MH, et al. · *Archives of dermatology*, 1998 · <https://doi.org/10.1001/archderm.134.4.471> · P129

FOUND Among 139 patients, agreement between live video teledermatology and in-person diagnoses was 80%.

WE TOOK Early benchmark that remote-vs-in-person diagnostic agreement plateaus around 80%, informing a realistic upper bound for noova's photo-based confidence.