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THE DOLIA METHOD: A SEQUENTIAL MULTIMODAL APPROACH TO NON-INVASIVE BODY CONTOURING

Summary

Non-invasive aesthetic modalities including ultrasonic cavitation, radiofrequency, vacuum therapy, and infrared stimulation are widely applied in clinical practice, yet no standardized methodology currently governs their coordinated sequencing within a single treatment protocol. The Dolia Method is a structured five-phase system that coordinates these modalities into a reproducible treatment coordination system, supported by conceptual models for directional treatment progression, inter-modality synergy, adaptive energy parameterization based on tissue density grading, and multidimensional outcome scoring through a Composite Transformation Score (CTS). A prospective observational case series was conducted at a single aesthetic practice in Colorado, USA, between October 2025 and April 2026. Twenty-two clients (19 female, 3 male; mean age 37.8 years) completed 8 to 10 sessions with circumferential measurements, tissue firmness assessments, and satisfaction scoring at baseline, midpoint, and endpoint. Mean endpoint circumferential reductions ranged from 2.8 cm at the upper thigh to 4.8 cm at the abdomen, with CTS values between 36 and 77 across participants. Transient mild erythema was the only adverse effect observed. The protocol is designed to be reproducible across practitioners and adaptable to different device ecosystems, supporting potential implementation across aesthetic clinic settings.

Limitations of the design, including the absence of a control group and the preliminary nature of the assessment instruments, are discussed alongside directions for controlled multi-site investigation.

Keywords: Dolia Method, sequential multimodal protocol, treatment coordination framework, non-invasive aesthetic methodology, composite outcome assessment, reproducible contouring system, adaptive parameterization

Introduction

Non-invasive fat reduction and skin tightening procedures are among the fastest-growing segments of outpatient aesthetic medicine. Data from the American Society for Dermatologic Surgery indicate that non-surgical body contouring treatments accounted for over 3.6 million procedures in the United States in 2022, representing a 16 percent increase compared to pre-pandemic levels [1].

Four hardware-based modalities dominate the current landscape of non-invasive aesthetic intervention. Low-frequency ultrasonic cavitation generates mechanical pressure oscillations that selectively disrupt adipocyte membranes, releasing stored triglycerides into the interstitial space, with clinical trials confirming measurable circumferential reduction in treated zones [2, 8]. Radiofrequency (RF) energy delivers controlled volumetric heating to dermal and subdermal layers, inducing collagen fiber contraction and triggering neocollagenesis through fibroblast activation, as confirmed by histological and immunohistochemical evidence [3, 9, 10]. Vacuum-assisted therapy combines mechanical suction with tissue mobilization, enhancing local lymphatic drainage and increasing lipolytic responsiveness in treated adipose depots [11, 14]. Infrared (IR) stimulation, most frequently studied as a component of combined devices, contributes to sustained local vasodilation and thermal support during tissue remodeling [15].

Despite documented individual effectiveness, these modalities are typically applied without a unified operational framework governing their coordination. Practitioners select devices and treatment order based on equipment availability, manufacturer instructions, or individual training rather than on a structured physiological sequencing model [5]. Kennedy et al. [4], reviewing four leading non-invasive fat reduction technologies, found that none of the clinical trials included in their analysis examined the effect of modality ordering on treatment outcomes. Mulholland et al. [5], in a separate review covering radiofrequency, ultrasound, cryolipolysis, and low-level laser therapy, acknowledged that the question of optimal sequencing remained unaddressed across the literature. Published protocols for combining three or more modalities within a single session are, as of the time of writing, absent from the peer-reviewed evidence base.

Available evidence nonetheless suggests that the order and coordination of modality application influences clinical outcomes. Friedmann [6] identified incomplete metabolite processing as a factor limiting volumetric outcomes when post-disruption clearance is insufficient. Physiological measurements have shown that mechanical stimulation along lymphatic pathways can enhance local lipolytic activity under controlled conditions [11]. Combined-modality device studies have reported larger circumferential reductions than single-modality protocols, though sealed device designs have prevented experimental separation of individual modality contributions or reordering of the treatment sequence [15, 16].

Outcome measurement presents a separate methodological challenge. Conventional assessment relies almost exclusively on circumferential tape measurement and clinical photography [4]. Circumference captures dimensional change but cannot differentiate between fat reduction, fluid redistribution, and tissue compaction. Skin elasticity, vascular response quality, and client-perceived improvement represent distinct outcome dimensions that a single metric does not reflect. Kennedy et al. [4] called for composite scoring systems capable of

integrating physiological and subjective indicators into a unified evaluation framework.

A further consideration is the regional heterogeneity of adipose tissue. Ibrahim [17] established that subcutaneous fat varies significantly in cellularity, vascularity, adrenergic receptor density, and metabolic activity depending on anatomical location. Abdominal subcutaneous fat tends to be more metabolically responsive to lipolytic stimuli, whereas gluteofemoral deposits are more fibrous and resistant to mobilization. Molecular-level evidence confirms that the magnitude of tissue response to mechanical treatment varies with local composition and vascular density [12].

The present article introduces the Dolia Method, an original operational framework for coordinated non-invasive aesthetic treatment, developed by the author through systematic clinical practice and iterative protocol refinement. The framework provides a reproducible treatment coordination system that sequences multiple modalities within a physiologically grounded cascade, adapts energy parameters to local tissue conditions through structured density grading, and evaluates outcomes across multiple dimensions using a composite scoring architecture. The aim of this study is to describe the conceptual architecture of the method and to report preliminary observational data from its clinical application. Specific objectives include: (1) presenting the structural components and physiological rationale of the protocol; (2) describing the study design, client population, and measurement instruments; (3) reporting circumferential, firmness, satisfaction, and composite outcome data across treatment zones; and (4) discussing methodological limitations, industry applicability, and directions for controlled investigation.

Literature Review

1. Ultrasonic Cavitation. Moreno-Moraga et al. [2] conducted one of the earliest prospective evaluations of non-thermal focused ultrasound for body

contouring. Thirty patients were treated with the UltraShape system operating at 200 kHz, receiving three sessions at one-month intervals with a one-month post-treatment follow-up. Standardized circumferential measurement showed reductions of 2 to 4 centimeters in abdominal and flank regions. No significant adverse events were reported. The single-modality design did not examine what happens to mobilized lipids after the session ends; no concurrent lymphatic intervention was applied and no measurements of post-treatment metabolite clearance were recorded.

ELdesoky et al. [8] compared cavitation and cryolipolysis in a randomized controlled trial of 60 subjects (BMI above 30), assigning participants to cavitation plus diet, cryolipolysis plus diet, or diet alone. Both device-treated groups achieved statistically significant reductions in waist circumference and skinfold thickness compared to diet-only controls at two months. No intermediate time-point data were collected, leaving the trajectory of tissue response between sessions uncharacterized.

Neither study addresses the fate of lipids released by cavitation in the hours following treatment; whether clearance rates change depending on what intervention follows cavitation has not been measured in any published trial.

2. Radiofrequency and Collagen Remodeling. Hsu and Kaminer [3] published one of the foundational clinical studies on monopolar RF for skin tightening, treating patients with a nonablative device delivering controlled thermal energy to dermal and subdermal layers of the lower face and neck. Immediate tissue contraction was observed during treatment, with sustained improvement in skin laxity documented at follow-up. Zelickson et al. [9] provided the histological basis for these observations through biopsies taken before and after nonablative RF application. Specimens revealed increased collagen density, reorganization of fibrillar architecture in the reticular dermis, and ultrastructural

evidence of active fibroblast proliferation, establishing that RF-induced tightening reflects genuine structural change in the dermal matrix rather than transient edema.

El-Domyati et al. [10] advanced this evidence through quantitative immunohistochemical analysis of 12 female subjects receiving monopolar RF to the face. Biopsies at baseline, one month, and three months demonstrated statistically significant increases in both type I and type III collagen, along with elevated tropoelastin and fibroblast activity markers. The staged temporal pattern of collagen deposition indicated that dermal remodeling unfolds over weeks rather than as a single event. Whether preceding tissue mobilization or lymphatic activation alters the dermal environment in ways that affect this remodeling sequence has not been investigated.

3. Vacuum-Assisted Therapy and Lymphatic Activation. Monteux and Lafontan [11] provided direct physiological measurement of lymphatic and lipolytic response to mechanical tissue stimulation. Using in vivo microdialysis probes inserted into femoral subcutaneous tissue, the study measured local glycerol concentration before and after a 12-session endermologie protocol. Post-treatment glycerol release increased significantly in treated tissue compared to untreated contralateral sites, confirming that sustained directional mechanical stimulation enhances lipolytic responsiveness. Microcirculatory parameters also improved in treated areas. The study did not examine whether timing this activation relative to other modalities would alter its effectiveness.

Marques et al. [12] extended the investigation to the molecular level through gene expression profiling of gluteofemoral adipose tissue biopsies from 10 female subjects. After 12 sessions of mechanical massage, significant upregulation was observed in genes encoding lipoprotein lipase and fatty acid transport proteins, alongside downregulation of lipogenesis-associated genes. Expression change magnitude varied between subjects, which the authors attributed partly to baseline differences in local tissue composition and vascular density, suggesting that

uniform treatment parameters may produce inconsistent molecular-level effects across patients.

Macedo et al. [13] examined manual lymphatic drainage for gynoid lipodystrophy in 20 women receiving 14 sessions over seven weeks, demonstrating statistically significant circumferential reduction and subjective improvement in 85 percent of participants, confirming that manual drainage alone can produce measurable dimensional change. Montesi et al. [14], in a 2025 review spanning therapeutic and aesthetic applications of endermologie, found consistent evidence for lymphatic activation and short-term circumferential improvement across studies, though long-term data beyond six months remain sparse and parameter standardization across studies is lacking.

4. Combined Modality Approaches. Adatto et al. [15] evaluated the VelaShape II system, which integrates bipolar RF, infrared light, pulsed vacuum, and mechanical massage within a single sealed applicator. In a study of 35 subjects receiving four treatment sessions, fat layer thickness was measured by diagnostic ultrasound at baseline and at one- and three-month follow-ups. Mean fat layer reduction reached 29 percent from baseline to the one-month assessment, with 93 percent of participants showing measurable change. Skin firmness assessed by a cutometer confirmed increased elasticity. Circumferential reductions at three months were 1.4 cm for the abdomen and flanks and 1.2 cm for the thighs, and 97 percent of subjects reported satisfaction. The sealed device design means that the individual contribution of each modality, and the effect of their internal sequencing, cannot be experimentally separated.

Manuskiatti et al. [16] applied the VelaShape platform in a post-pregnancy context, treating 20 women with five weekly sessions targeting the abdomen, buttocks, and thighs. Mean circumferential reduction was 5.4 cm ($p < 0.001$), with skin laxity improvement reaching statistical significance ($p < 0.02$) on both physician and patient assessments. Two minor adverse events were recorded: one

purpura and one mild burn. The substantially larger reductions compared to those reported by Adatto et al. [15] may reflect greater baseline tissue laxity and fluid retention in post-partum subjects, though direct comparison between the two studies is not possible given differences in population, measurement protocol, and follow-up timing. Separately, Manstein et al. [7] established through cryolipolysis that non-invasive, technology-mediated adipocyte destruction can produce clinically meaningful volumetric reduction, broadening the evidence base for energy-based body contouring as a treatment category.

5. Unresolved Questions. Analysis of the reviewed studies identifies four specific questions that the current evidence base has not addressed. First, because existing combined-modality platforms use fixed internal sequencing that cannot be experimentally manipulated, no published trial has isolated the effect of modality order on treatment outcomes when three or more technologies are involved. Second, the interaction between cavitation-induced lipid release and subsequent lymphatic clearance has not been measured directly: separate studies confirm adipocyte disruption and mechanical stimulation of lymphatic transport, but no study examines whether timing lymphatic activation before, during, or after cavitation changes clearance rates. Third, no published framework aggregates circumferential change, tissue elasticity, volumetric response, and patient-reported outcomes into a single composite score validated across practitioners or settings. Fourth, adaptive treatment parameterization based on local tissue density grading has not been tested against fixed-parameter protocols under controlled conditions.

Materials and Methods

1. Study Design and Setting. A prospective observational case series was conducted at iContour Aesthetics & Spa (Centennial, Colorado, USA) between October 2025 and April 2026. All clients provided written informed consent for treatment and for anonymized data use. No randomization, blinding, or control group was employed. All treatments were delivered by a single practitioner (the

author). Equipment included a cavitation unit (36 to 40 kHz, 10 to 50 W), a multipolar RF device with real-time temperature monitoring (target 40 to 42 degrees Celsius), a vacuum-assisted roller system (20 to 80 kPa), and an infrared panel (700 to 1200 nm). All devices were calibrated at the start of the study period.

2. Participants. Participants were recruited from the existing client base of the practice through direct invitation during routine consultations. The sample was a convenience sample; no external advertising or referral incentives were used. Twenty-two adult clients enrolled in and completed the study. Nineteen were female and three were male. Age ranged from 26 to 56 years, with a mean of 37.8 years (SD 8.2). Body mass index at enrollment ranged from 21.4 to 34.6 (mean 27.9, SD 3.7).

Inclusion criteria were: age 18 years or older; BMI between 21 and 35; clinically visible localized fat deposits in at least one target zone; willingness to comply with post-treatment guidelines; and ability to attend sessions at 5- to 7-day intervals. Exclusion criteria were: pregnancy or lactation; active skin infection in any treatment zone; implanted electronic device; surgical body contouring within the preceding 12 months; uncontrolled metabolic disorder; anticoagulant use; and known hypersensitivity to topical agents used in the protocol.

3. Treatment Protocol. Each client underwent a course of 8 to 10 treatment sessions, delivered at intervals of 5 to 7 days. Treatment zones were selected at intake based on each client's areas of concern and confirmed by clinical assessment. All 22 clients received treatment to the abdomen; 18 also received treatment to the waist and flanks; and 12 received treatment to the upper thighs. Clients with multiple zones received all zones within a single session; no client was treated on fewer than one zone or more than three zones per session.

Each session followed a five-phase sequential protocol: Phase 1, preparatory activation (cleansing, conductive gel, parameter verification; 3 to 5 minutes);

Phase 2, adipocyte mobilization via ultrasonic cavitation at 36 to 40 kHz (10 to 15 minutes per zone); Phase 3, lymphatic priming through manual rhythmic drainage along anatomical pathways (5 to 10 minutes); Phase 4, thermo-mechanical remodeling combining RF at 40 to 42 degrees Celsius with vacuum roller manipulation and infrared support (15 to 20 minutes per zone); and Phase 5, consolidation through secondary drainage, topical calming, and post-treatment guidance (3 to 5 minutes). Total session duration ranged from 50 to 70 minutes. The conceptual rationale for this sequencing is presented in Section 4.1.

At intake, treatment zones were classified by adipose tissue density using a four-grade scale (AD-I through AD-IV) based on clinical palpation, tissue firmness, and skin elasticity. Treatment parameters (cavitation duration, RF intensity, vacuum level) were set according to the assigned grade, with AD-I receiving the lowest settings and AD-IV the highest within defined safety limits. Specific ranges are presented in Table 1 (Section 4.1).

After the third session, intermediate progress was evaluated against expected response thresholds based on the client's density grade. If circumferential reduction and firmness improvement were consistent with expected trajectory, parameters were maintained. If response fell below expected thresholds, cavitation duration was extended by 2 to 3 minutes per zone and vacuum intensity was increased by one level. If the client reported heightened tissue sensitivity or showed signs of overtreatment (persistent erythema exceeding 6 hours, localized tenderness), parameters were reduced. Decision logic for these adjustments is described in Section 4.1.

All clients received standardized post-treatment instructions at each visit: hydration of at least 1.5 liters within 4 hours, avoidance of alcohol and high-sodium foods for 48 hours, and light physical activity within 24 hours. Compliance was self-reported at each subsequent session.

4. Outcome Measures. Circumferential measurements were taken using a non-elastic tape with a spring-loaded tension indicator at four landmarks: natural waist, umbilical-level abdomen, bilateral flanks at iliac crest level, and widest upper thigh. Measurements were recorded at baseline, midpoint (after Session 5), and endpoint (7 days after the final session). All measurements were taken by the same practitioner under standardized conditions (standing position, end of normal expiration, morning appointment window).

Tissue firmness was assessed at each time point using the Tissue Elasticity Improvement Scale (TEIS), a practitioner-administered 6-point ordinal scale (0 to 5) designed for use within this protocol. A score of 0 indicated no palpable change from baseline; 5 indicated maximum perceptible improvement in skin tightness and elastic recoil. TEIS scores were assigned through standardized palpation of the treated zone immediately before circumferential measurement. As a preliminary practitioner-calibrated instrument, TEIS has not yet undergone formal inter-rater reliability testing; its application in this study is exploratory, and external validation is a planned direction for subsequent research.

Client satisfaction was recorded at endpoint using a structured questionnaire designed for this study, covering five domains: perceived change in body contour, perceived change in tissue firmness, comfort during sessions, satisfaction with recovery, and overall willingness to recommend the treatment. Each domain was scored from 1 (very dissatisfied) to 10 (very satisfied). Responses were converted into a Patient Satisfaction Weighted Score (PSWS) using the formula PSWS = (sum of domain scores / number of domains) / 10, yielding a normalized index between 0 and 1. PSWS functions as an initial operational scoring system designed to capture multi-domain client perception; independent psychometric validation is a planned direction for future work.

Circumferential reduction was expressed as a Circumference Reduction Index (CRI), calculated as percentage change from baseline. A Volume Response

Coefficient (VRC) was calculated by averaging CRI across three abdominal measurement levels (waist, umbilical abdomen, flanks). A Composite Transformation Score (CTS) was calculated at endpoint using the formula: CTS = 0.40 x CRI + 0.20 x TEIS + 0.20 x PSWS + 0.20 x VRC, where N denotes normalization of each component to a 0-100 scale. CRI and VRC, expressed as percentage change, were normalized by dividing by 11 (the reference clinical ceiling for single-course circumference reduction) and multiplying by 100. TEIS was normalized by dividing by the scale maximum (5) and multiplying by 100. PSWS was normalized by multiplying by 100. CRI received the highest weighting (40 percent) because circumferential change is the most direct and objective indicator of contour modification. TEIS, PSWS, and VRC each contributed 20 percent, representing elasticity, client perception, and volumetric dimensions respectively. Weight allocation was based on clinical judgment regarding the relative importance of each outcome dimension; empirical optimization of weights was beyond the scope of this observational study. CTS is intended to serve as an operational metric that consolidates multiple outcome dimensions into a single trackable index, enabling comparison across treatment courses and between practitioners.

5. Data Analysis. All measurements were recorded in a structured digital database (Microsoft Excel, version 16.0) and verified for entry errors prior to analysis. Descriptive statistics (mean, standard deviation, range) were calculated for circumferential change at each measurement site and time point, for each DQAM component score, and for the CTS. Results are reported as group-level observational trends. Given the small sample size (n = 22) and absence of a control group, inferential statistical testing was not performed. Subgroup analysis by age, BMI, or adipose density grade was not conducted due to insufficient statistical power.

Results

1. Conceptual Innovation: Methodological Architecture. The conceptual innovation of the Dolia Method lies not in the individual technologies employed, each of which is commercially available and independently documented in the literature, but in the structured integration logic that governs their coordinated application. Five interrelated models define this architecture: a directional sequencing model (PCSCM), an inter-modality coordination model (DMSM), an adaptive parameterization hierarchy (EMH), a midcourse response adjustment algorithm (ARAA), and a multidimensional outcome evaluation matrix (DQAM). Each model addresses a specific methodological gap identified in the literature review, and together they constitute a reproducible protocol system designed for operator-independent implementation across clinical settings.

1.1. Peripheral-to-Central Sequential Contouring Model (PCSCM). Conventional protocols typically begin at the site of greatest visible adipose accumulation. This prioritizes cosmetic visibility but does not account for the directional architecture of the lymphatic system. If central zones are treated before peripheral drainage pathways have been stimulated, mobilized metabolites may encounter greater resistance in resting lymphatic vessels, reducing clearance efficiency.

The PCSCM organizes treatment zones into three functional categories aligned with lymphatic anatomy. Peripheral activation zones (upper arms, lateral thighs, calves) are where lymphatic collectors originate; stimulating these first reduces downstream drainage resistance. Transitional drainage corridors (inner thighs, lateral torso) connect peripheral collectors with central trunks. Central accumulation zones (abdomen, waist, flanks, lower back) contain the primary adipose deposits and are addressed last. In practice, the practitioner activates lymphatic flow in the extremities and lateral torso before applying cavitation to the abdomen, so that by the time adipocyte contents are mobilized the drainage network is already activated.

1.2. Dynamic Multimodal Synergy Model (DMSM). The five-phase treatment sequence is not an arbitrary arrangement of available technologies. Each phase produces a specific physiological state in the treated tissue that the subsequent phase requires in order to operate at maximum efficiency. Cavitation disrupts adipocyte membranes and releases intracellular lipids, creating a localized surplus of triglycerides and free fatty acids in the interstitial space. If left unaddressed, these metabolites may clear more slowly through passive physiological processes. Manual lymphatic priming, applied immediately after cavitation, activates directional fluid movement along anatomical drainage pathways, accelerating transport of newly released lipids toward processing centers.

Radiofrequency, applied after lymphatic priming, acts on tissue that has already been mechanically stimulated and partially cleared of excess interstitial fluid. Reduced fluid volume in the treatment zone allows RF energy to penetrate more efficiently into dermal collagen structures, because excess interstitial fluid may absorb and disperse a portion of RF energy, reducing the proportion that reaches dermal collagen at target depth. Vacuum-assisted roller manipulation, delivered concurrently with RF, mechanically compresses and lifts tissue layers, further reducing the distance between the RF electrode and dermal collagen fibers. Infrared energy, applied during and after the thermo-mechanical phase, sustains the elevated tissue temperature and capillary dilation achieved by RF, extending the window during which collagen contraction and fibroblast activation occur.

The DMSM defines a cascade in which each modality creates a tissue state that enhances delivery and effectiveness of the next. Reversing the order would compromise the logic at multiple points: applying RF before cavitation would heat tissue that still contains intact adipocytes rather than mobilized lipids; performing lymphatic priming before cavitation would activate drainage pathways with no mobilized metabolites to transport; and omitting IR after RF would allow rapid

temperature decline in the treatment zone, narrowing the collagen contraction window. Controlled comparative testing of alternative sequences has not yet been performed, but the physiological rationale for the current ordering is grounded in the staged dependency of each tissue response on the preceding phase. Figure 1 illustrates the five-phase architecture.

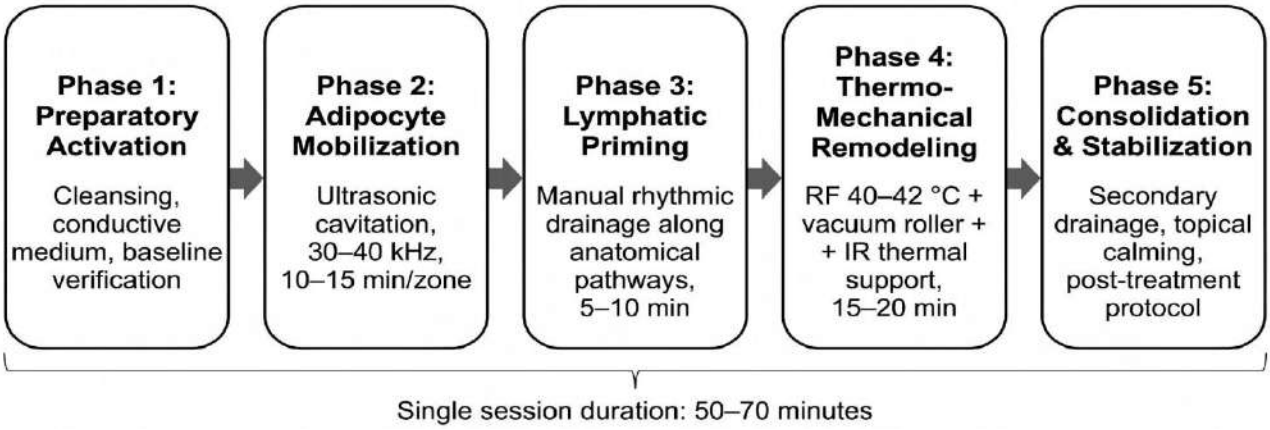


Figure 1. Five-Phase Sequential Treatment Architecture of the Dolia Method
Source: Author's development.

Figure 2 shows the corresponding tissue-level physiological responses across the four active treatment phases.

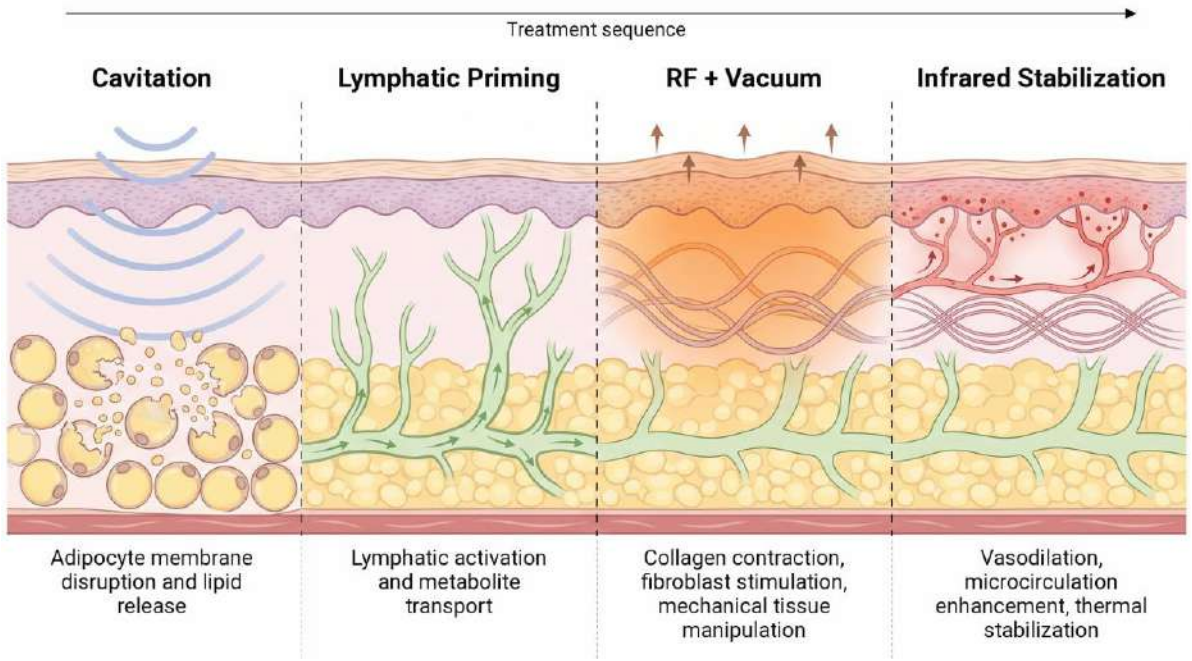


Figure 2. Schematic Representation of Physiological Tissue Response Across Treatment Phases
Source: Author's development.

1.3. Energy Modulation Hierarchy (EMH). Adipose tissue varies in density, fibrous content, vascularity, and elasticity across body regions and between individuals. Applying uniform energy parameters to all tissue types disregards these differences and risks undertreating dense deposits while overtreating responsive tissue. The EMH provides a structured mapping between tissue characteristics assessed at intake and treatment intensity parameters. Four adipose density grades (AD-I through AD-IV), assigned through clinical palpation, determine the starting ranges for cavitation duration, RF intensity, and vacuum pressure (Table 1).

Table 1. Energy Modulation Hierarchy: Parameter Ranges by Adipose Density Grade

Grade	Classification	Cavitation (per zone)	RF Intensity	Vacuum Level	Clinical Characteristics
AD-I	Low density	8 - 10 min	Low to moderate	Low	Mild adiposity, firm tissue, good skin recoil
AD-II	Moderate density	10 - 12 min	Moderate	Moderate	Visible accumulation, moderate tissue softness
AD-III	High density	12 - 15 min	Moderate to high	Moderate to high	Dense deposits, thicker subcutaneous layer
AD-IV	Very high density	15 - 18 min	High (within safety limits)	High	Large or fibrotic deposits, reduced elasticity

Source: Author's development based on the Dolia Method framework.

At intake, 6 of 22 clients were classified as AD-I, 9 as AD-II, 5 as AD-III, and 2 as AD-IV. Grading was performed by the same practitioner across all clients to ensure classification consistency.

1.4. Adaptive Response Adjustment Algorithm (ARAA). Fixed-parameter protocols assume uniform physiological response across clients, which contradicts documented inter-individual variability in tissue composition and metabolic function [12, 17]. The ARAA introduces structured decision logic at a checkpoint

after Session 3. At this point, observed CRI and TEIS values are compared against grade-specific expected response thresholds. For AD-I, expected midpoint CRI is 2.5 to 4.0 percent, reflecting lower tissue resistance; for AD-II, the range is 2.0 to 3.5 percent. For AD-III and AD-IV, expected values are lower (1.5 to 3.0 percent and 1.0 to 2.5 percent respectively), reflecting greater tissue density and slower mobilization. If observed CRI falls below the expected range, the algorithm recommends modest escalation of cavitation duration and vacuum intensity within the ranges defined for the next higher density grade. If the client reports heightened sensitivity or shows persistent erythema exceeding 6 hours, parameters are reduced by one intensity level. If values fall within or above the expected range, parameters remain unchanged. Specific adjustment increments are defined in the treatment protocol (Section 3.3). Application of this algorithm in the present study is reported in Section 4.2.

1.5. Dolia Quantitative Assessment Matrix (DQAM). Circumferential measurement captures one dimension of contour change but cannot distinguish between fat reduction, fluid shift, and tissue compaction. Practitioner-assessed firmness captures elasticity change but is subjective. Client satisfaction captures perceived value but is shaped by expectations and interpersonal dynamics. No single metric adequately represents the multidimensional nature of tissue transformation. The DQAM combines four indicators, each targeting a distinct outcome dimension, into a weighted Composite Transformation Score: CRI for dimensional change, TEIS for tissue quality, PSWS for client perception, and VRC for multi-level volumetric change. Calculation formulas and weighting rationale were described in Section 3.4.

Table 2. Composite Transformation Score: Component Structure and Weighting

Component	Full Name	Weight	Scale	Outcome Dimension Captured
CRI	Circumference Reduction Index	0.40	% change	Dimensional contour modification at landmark level
TEIS	Tissue Elasticity Improvement Scale	0.20	0 - 5	Practitioner-assessed tissue firmness and elastic recoil
PSWS	Patient Satisfaction Weighted Score	0.20	0 - 1	Multi-domain client perception of treatment value
VRC	Volume Response Coefficient	0.20	% change	Multi-level volumetric change within primary zone

Source: Author's development.
**CTS = 0.40 x N(CRI) + 0.20 x N(TEIS) + 0.20 x N(PSWS) + 0.20 x N(VRC), where N normalizes each component to a 0-100 scale.*

From a practical standpoint, CTS addresses three operational limitations of current assessment practice. First, it reduces fragmented evaluation by consolidating separate measurements into a single comparable index, replacing the need for practitioners to interpret multiple unrelated indicators independently. Second, it improves comparability between practitioners and clinical settings by providing a standardized numerical output that can be tracked across treatment courses, operators, and institutional contexts. Third, it enables multidimensional treatment evaluation, ensuring that outcomes where circumferential change occurs without firmness improvement, or where client satisfaction diverges from measured change, are captured rather than masked by a single-metric approach.

2. Observational Outcome Data

All 22 clients completed at least 8 sessions; 14 completed the full 10-session course. The 8 clients who completed 8 sessions did so by personal choice: 5 cited scheduling constraints, and 3 reported satisfaction with results achieved by

Session 8 and elected not to continue. No withdrawals due to adverse events or dissatisfaction occurred. Mean circumferential reduction by treatment zone and time point is presented in Table 3.

Table 3. Mean Circumferential Reduction (cm) by Treatment Zone and Time Point

Treatment Zone	n	Baseline Mean (cm)	Midpoint Change (cm)	Endpoint Change (cm)	SD
Waist	22	83.9	-2.0	-4.1	1.52
Abdomen	22	91.7	-2.3	-4.8	1.61
Flanks	18	97.4	-1.5	-3.4	1.38
Upper thigh	12	59.2	-1.2	-2.8	1.14

Source: Author's observational data, iContour Aesthetics & Spa, 2025-2026.

Circumferential change was progressive across both measurement intervals, with a larger proportion of total reduction occurring between the midpoint and endpoint assessments. Abdomen and waist zones showed the largest absolute reductions. Upper thigh reductions were smaller, consistent with the lower number of sessions delivered to this zone and the denser tissue composition characteristic of this region [17].

DQAM component scores and Composite Transformation Scores are summarized in Table 4.

TEIS scores improved by at least one point in 18 of 22 clients. Four clients showed only minimal firmness improvement (TEIS = 1) despite measurable circumferential reduction. PSWS reached 0.80 or higher in 17 of 22 cases. Clients completing 10 sessions achieved a mean CTS of 61.3, compared to 48.7 among those completing 8 sessions.

Descriptive breakdown of mean abdomen CRI by EMH density grade yielded the following values: AD-I (n = 6), 5.8 percent; AD-II (n = 9), 5.3 percent; AD-III (n = 5), 4.7 percent; AD-IV (n = 2), 4.2 percent. A downward trend in CRI with

increasing density grade was observed, though the subgroup sizes, particularly AD-IV (n = 2), are insufficient for statistical comparison. Whether the EMH parameter scaling partially compensated for greater tissue resistance in higher-density grades cannot be determined from these data.

Table 4. DQAM Component Scores and Composite Transformation Score (n = 22)

Component	Mean	SD	Min	Max
CRI (%, abdomen)	5.2	1.8	2.3	8.1
TEIS (0 - 5 scale)	3.1	0.9	1.0	5.0
PSWS (0 - 1 index)	0.82	0.11	0.55	0.96
VRC (%, abdomen)	4.8	1.6	1.9	7.6
CTS (composite)	56.4	10.2	38	74

Source: Author's calculation based on the DQAM framework. CRI and VRC from abdomen zone data.

ARAA-triggered parameter adjustments were applied in 7 of 22 cases (31.8 percent) after Session 3. Five received upward parameter escalation (extended cavitation duration and increased vacuum intensity, per the adjustment increments defined in Section 3.3). Two received RF intensity reduction due to heightened skin sensitivity. Mean midpoint CRI in the adjusted group prior to modification was 1.4 percent; mean endpoint CRI in the same group reached 5.6 percent, compared to 5.0 percent in the 15 non-adjusted clients. Mean CTS in the adjusted group was 59.1 versus 55.2 in the non-adjusted group. Given the small and uncontrolled nature of these subgroups, no causal inference can be drawn from this comparison.

No serious adverse events were recorded. Transient mild erythema, resolving within 1 to 3 hours, was observed in 15 of 22 clients (68.2 percent). Six clients reported temporary localized sensitivity in vacuum-treated areas, resolving within

24 hours without intervention. No episodes of blistering, bruising, pigmentation change, or persistent pain occurred.

Discussion

Mean endpoint circumferential reduction at the abdomen (4.8 cm over 8 to 10 sessions) exceeds the 2 to 4 cm range reported by Moreno-Moraga et al. [2] for cavitation alone after three sessions, and the 1.4 cm reported by Adatto et al. [15] for VelaShape II after four sessions. It falls below the 5.4 cm reported by Manuskiatti et al. [16] in post-partum subjects after five sessions. Direct comparison is constrained by differences in population, baseline tissue laxity, session count, and follow-up timing. Post-partum subjects likely presented with greater baseline fluid retention and distensibility, amplifying early change; the Adatto study used a shorter course with a longer follow-up window in which partial recovery may have occurred. That the present multimodal protocol exceeded cavitation-only reductions is consistent with the premise that coordinated sequencing adds measurable value, though the session count difference (3 versus 8 to 10) limits the strength of this comparison.

The PCSCM rests on the premise that activating peripheral lymphatic pathways before treating central zones improves metabolite clearance. Friedmann [6] established that volumetric outcomes depend on downstream clearance capacity, not solely on adipocyte disruption count, while Monteux and Lafontan [11] confirmed that the drainage system responds to targeted mechanical activation. Whether peripheral-first sequencing produces better clearance than simultaneous or reversed ordering remains untested, and formal evaluation would require a controlled trial comparing these approaches.

The DMSM formalizes the principle that each treatment phase must create specific tissue conditions required by the subsequent phase. One specific mechanism advanced in Section 4.1 is that lymphatic priming after cavitation reduces interstitial fluid volume, potentially improving RF penetration into dermal

collagen. While no published study has directly measured RF penetration depth as a function of prior lymphatic drainage, the general principle that fluid-rich tissue attenuates electromagnetic energy delivery is consistent with the biophysics of RF interaction with biological media. A notable feature of the present study design is the use of separate, independently controlled devices for each modality. Unlike fixed-platform systems where modality sequencing is determined by the manufacturer, the independent-device approach permits deliberate manipulation of phase order, duration, and intensity at each stage. This design characteristic is a prerequisite for any future controlled comparison of alternative sequencing strategies within the DMSM framework.

Descriptive breakdown of CRI by adipose density grade showed a modest downward gradient from AD-I (5.8 percent) to AD-IV (4.2 percent). One interpretation is that denser, more fibrous tissue responds less readily to cavitation-mediated mobilization even when longer exposure times are applied, consistent with Ibrahim's findings regarding regional differences in subcutaneous fat structure [17]. An alternative interpretation is that the EMH parameter scaling partially compensated for tissue resistance, narrowing the outcome gap between grades. The subgroup sizes in this study (particularly n = 2 for AD-IV) are far too small to distinguish between these explanations, and a larger sample with balanced density-grade distribution would be needed to evaluate EMH calibration empirically.

The 7 clients who received ARAA-triggered adjustments after Session 3 had a mean midpoint CRI of 1.4 percent, below their grade-specific expected thresholds. After parameter modification, their mean endpoint CRI reached 5.6 percent, compared to 5.0 percent in the 15 non-adjusted clients. While this trajectory is consistent with the hypothesis that midcourse adaptation can recover suboptimal early response, the uncontrolled design prevents attribution to the adjustment itself. Clients in the adjusted group may have differed from non-

adjusted clients in hydration habits, activity levels, or metabolic characteristics not captured by the density grading. A randomized comparison between adaptive and fixed-parameter arms, controlling for baseline characteristics, would be needed to evaluate ARAA effectiveness independently.

Clients completing 10 sessions achieved a mean CTS of 61.3 versus 48.7 for those completing 8 sessions. Whether this reflects a dose-response relationship or a self-selection effect (three of the 8-session clients stopped because they considered results sufficient) cannot be determined without a design in which session count is assigned rather than self-selected.

CTS values in this study ranged from 36 to 77, establishing a preliminary numerical benchmark for the DQAM framework. Because CTS is a newly developed composite score without published reference ranges, these values cannot yet be interpreted against an established performance standard. However, the observation that 4 of 22 clients showed measurable circumferential reduction without corresponding firmness improvement illustrates a practical limitation of single-metric assessment: in these cases, CRI alone would have classified the outcome as successful while tissue quality remained unchanged. By consolidating dimensional, elasticity, perceptual, and volumetric indicators into a single index, CTS provides practitioners with a structured basis for treatment evaluation that reduces reliance on fragmented interpretation of unrelated measurements. Whether specific CTS thresholds correspond to clinically meaningful outcome categories remains to be established through validation against patient-reported long-term outcomes and clinician-rated global improvement scales.

Transient erythema (68.2 percent) and temporary localized sensitivity (27.3 percent) were the only adverse effects observed, consistent with published safety profiles for VelaShape [15] and similar combined-modality protocols [16]. The absence of blistering, bruising, pigmentation change, or persistent pain suggests that the five-phase protocol did not introduce safety risks beyond those associated

with individual modality application, though the small sample limits power to detect rare events.

Beyond its clinical performance, the Dolia Method was designed as a transferable operational system. The protocol relies on device categories (cavitation units, RF systems, vacuum rollers, infrared panels) rather than specific proprietary platforms, making it adaptable to different device ecosystems available across aesthetic clinics. Treatment parameters are governed by the EMH grading system and ARAA decision logic rather than by practitioner intuition, which supports reproducibility across operators with varying levels of experience. The five-phase architecture and structured assessment instruments (CRI, TEIS, PSWS, CTS) establish a shared operational language for standardized practitioner training, cross-operator quality comparison, and institutional outcome benchmarking. Whether these design features translate into consistent real-world implementation across diverse clinical environments remains to be tested through multi-site adoption studies.

Several study design limitations must be acknowledged. First, the absence of a control group means that observed reductions cannot be attributed solely to the protocol; dietary changes, physical activity, hydration behavior, and natural weight fluctuation may have contributed. Second, all treatments were delivered by a single practitioner at a single site, limiting generalizability to other operators and settings. Third, the sample size of 22 is insufficient for meaningful subgroup analysis by age, BMI, or density grade. Fourth, the endpoint measurement was taken 7 days after the final session, with no follow-up at 3 or 6 months; whether effects are maintained, diminished, or continue to develop beyond this window is unknown. Fifth, compliance with post-treatment hydration, dietary, and activity recommendations was self-reported and not objectively verified.

Measurement-related limitations are equally important. TEIS, functioning as a preliminary practitioner-calibrated instrument, was administered by a single

operator in this study; inter-rater reliability testing and validation against objective devices such as cutometer or shear-wave elastography are necessary before it can be adopted across clinical settings. PSWS, an exploratory assessment tool designed to capture multi-domain client perception, has not undergone independent psychometric validation; responses may have been influenced by social desirability or practitioner-client rapport. CTS component weights (0.40/0.20/0.20/0.20) were assigned based on clinical judgment rather than empirical optimization, and alternative weighting configurations may produce different composite rankings. Formal validation of each instrument is a prerequisite for CTS to function as a reliable comparative metric across studies and practitioners.

Conclusions

This study presented the Dolia Method as an original operational framework for coordinated non-invasive aesthetic treatment, comprising a structured adaptive protocol with integrated sequencing logic, adaptive parameterization, and multidimensional outcome evaluation. Preliminary evaluation through an observational case series of 22 clients demonstrated the operational viability of four interrelated conceptual models: directional treatment sequencing (PCSCM), physiologically grounded modality coordination (DMSM), adaptive parameter selection (EMH/ARAA), and composite outcome scoring (DQAM/CTS).

Observational data showed progressive circumferential reduction across all treated zones, with mean endpoint values ranging from 2.8 to 4.8 cm depending on anatomical site and session count. Firmness improvement was observed in 18 of 22 clients, satisfaction scores exceeded 0.80 on a normalized index in 17 of 22 cases, and CTS values ranged from 36 to 77. Midcourse parameter adjustments applied in 7 cases were followed by endpoint CRI values exceeding the group mean, though the uncontrolled design does not permit causal attribution. No

serious adverse events were recorded, and the safety profile was consistent with published data for the individual modalities involved.

The protocol's reliance on device categories rather than specific proprietary platforms, its structured parameter logic, and its standardized assessment instruments position it as a potentially reproducible system applicable across aesthetic clinics and adaptable to different practitioner backgrounds and equipment configurations. These findings should be interpreted within the constraints of a single-site observational design with no control group and limited follow-up. Controlled multi-site trials with larger populations, randomized comparison arms (including fixed-parameter and alternative-sequencing controls), objective elasticity measurement, validated satisfaction instruments, and follow-up periods of at least 6 months are necessary to evaluate the protocol, its component models, and its scalability across clinical environments. Empirical validation of CTS weighting, inter-rater reliability testing of TEIS and EMH grading, and formal dose-response analysis across session counts represent priority directions for subsequent investigation. As a structured methodology publication presenting an original operational framework for coordinated non-invasive aesthetic treatment systems, this work is intended to contribute to the standardization and professionalization of multimodal protocol design in the field.

References

1. American Society for Dermatologic Surgery. (2023). ASDS Survey on Dermatologic Procedures 2022. Dermatologic Surgery, 49(Suppl 1), S1-S24. https://www.asds.net/

2. Moreno-Moraga, J., Valero-Altes, T., Riquelme, A. M., Isarria-Marcosy, M. I., & de la Torre, J. R. (2007). Body contouring by non-invasive transdermal focused ultrasound. Lasers in Surgery and Medicine, 39(4), 315-323. https://doi.org/10.1002/lsm.20478

3. Hsu, T. S., & Kaminer, M. S. (2003). The use of nonablative radiofrequency technology to tighten the lower face and neck. Seminars in Cutaneous Medicine and Surgery, 22(2), 115-123. https://pubmed.ncbi.nlm.nih.gov/12828470/

4. Kennedy, J., Verne, S., Griffith, R., Falto-Aizpurua, L., & Nouri, K. (2015). Non-invasive subcutaneous fat reduction: a review. Journal of the European Academy of Dermatology and Venereology, 29(9), 1679-1688. https://doi.org/10.1111/jdv.12994

5. Mulholland, R. S., Paul, M. D., & Chalfoun, C. (2011). Noninvasive body contouring with radiofrequency, ultrasound, cryolipolysis, and low-level laser therapy. Clinics in Plastic Surgery, 38(3), 503-520. https://doi.org/10.1016/j.cps.2011.02.003

6. Friedmann, D. P. (2015). A review of the aesthetic treatment of abdominal subcutaneous adipose tissue: Background, implications, and therapeutic options. Dermatologic Surgery, 41(1), 18-34. https://doi.org/10.1097/DSS.0000000000000229

7. Manstein, D., Laubach, H., Watanabe, K., Farinelli, W., Zurakowski, D., & Anderson, R. R. (2008). Selective cryolysis: a novel method of non-invasive fat removal. Lasers in Surgery and Medicine, 40(9), 595-604. https://doi.org/10.1002/lsm.20719

8. ELdesoky, M. T. M., Abutaleb, E. E. M., & Mousa, G. S. M. (2016). Ultrasound cavitation versus cryolipolysis for non-invasive body contouring. Australasian Journal of Dermatology, 57(4), 288-293. https://doi.org/10.1111/ajd.12465

9. Zelickson, B. D., Kist, D., Bernstein, E., Brown, D. B., Ksenzenko, S., Burns, J., Kilmer, S., Mehregan, D., & Pope, K. (2004). Histological and ultrastructural evaluation of the effects of a radiofrequency-based nonablative

dermal remodeling device. Archives of Dermatology, 140(2), 204-209. https://doi.org/10.1001/archderm.140.2.204

10. El-Domyati, M., El-Ammawi, T. S., Medhat, W., Moawad, O., Brennan, D., Mahoney, M. G., & Uitto, J. (2011). Radiofrequency facial rejuvenation: Evidence-based effect. Journal of the American Academy of Dermatology, 64(3), 524-535. https://doi.org/10.1016/j.jaad.2010.09.055

11. Monteux, C., & Lafontan, M. (2008). Use of the microdialysis technique to assess lipolytic responsiveness of femoral adipose tissue after 12 sessions of mechanical massage technique. Journal of the European Academy of Dermatology and Venereology, 22(12), 1465-1470. https://doi.org/10.1111/j.1468-3083.2008.02832.x

12. Marques, M. A., Combes, M., Roussel, B., Vidal-Dupont, L., Thalamas, C., Lafontan, M., & Viguerie, N. (2011). Impact of a mechanical massage on gene expression profile and lipid mobilization in female gluteofemoral adipose tissue. Obesity Facts, 4(2), 121-129. https://doi.org/10.1159/000323403

13. Macedo, A. C. B., Curti, H. R. V., & Gomes, J. R. (2014). Longitudinal evaluation of manual lymphatic drainage for the treatment of gynoid lipodystrophy. Anais Brasileiros de Dermatologia, 89(5), 712-718. https://doi.org/10.1590/abd1806-4841.20142856

14. Montesi, G., Lupi, O., & Silveira, I. (2025). Endermologie as a complementary therapy in medicine and surgery and an effective aesthetic procedure: A literature review. Applied Sciences, 15(8), 4313. https://doi.org/10.3390/app15084313

15. Adatto, M. A., Adatto-Neilson, R. M., & Morren, G. (2014). Reduction in adipose tissue volume using a new high-power radiofrequency technology combined with infrared light and mechanical manipulation for

body contouring. Lasers in Medical Science, 29(5), 1627-1631. https://doi.org/10.1007/s10103-013-1468-5

16. Manuskiatti, W., Wachirakaphan, C., Lektrakul, N., & Varothai, S. (2009). Post-pregnancy body contouring using a combined radiofrequency, infrared light and tissue manipulation device. Journal of Cosmetic and Laser Therapy, 11(4), 229-235. https://doi.org/10.1080/14764170903234617

17. Ibrahim, M. M. (2010). Subcutaneous and visceral adipose tissue: structural and functional differences. Obesity Reviews, 11(1), 11-18. https://doi.org/10.1111/j.1467-789X.2009.00623.x