

Anthropometric Features Associated with Aging and Their Impact on Permanent Makeup (PMU) Technique

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ABSTRACT

The aging-related anthropometric changes, including brow ptosis, periocular hooding, soft tissue descent, and dermal atrophy are known to have an effect on the results of PMU, but there are very few original clinical studies describing how technique may be altered for an aging patient. The current retrospective observational study examined 142 female clients (mean age 61.3 ± 9.2) who received anthropometrically guided PMU treatments (2021-2025). Prior to the procedure, females' eyebrows, periocular region, and skin quality were assessed through systematic measurements. Results were reviewed at various follow-up intervals. Amongst aging the areas with the most statistically significant ($p < 0.001$) increase in severity were brow ptosis and skin atrophy. Powder and nano techniques resulted in the most pigment retention (85.2%) followed by microblading (64.4%) atrophic skin. Anthropometric-adapted mapping had the highest population-wide symmetry (88.7%), submitted client satisfaction scores (mean 4.6/5) along with the lowest complication rate (7.0%). Aged facial anthropometry when incorporated systematically into PMU procedures may lead to optimum safety, retention, and aesthetic results in an aging client.

1. Introduction

Aging face is a dynamic and multi-factorial process characterized by the gradual anthropometric changes that have been defined to alter the landmarks of the face structure and soft tissue to lend to an aged appearance. These modifications involve bone resorption, redistribution and atrophy of subcutaneous fat pads, laxity of true ligamentous tissues and dermal atrophy leading to aging of the adult face. These anthropometric changes are of particular significance in the periorbital, supraciliary and perioral areas as these represent the prime regions for PMU techniques including microblading, powder brows, liner and lip blush techniques. An understanding of age related changes in these regions is therefore essential in the current era of growing society of aged clients seeking PMU techniques (Marwah et al., 2021; Kwon et al., 2021).

Facial anthropometry is characterized by an oval or heart-shaped structure with high prominent cheekbones, well-supported and adequate thickness of soft tissues with well delineated eyebrows just superior to the supraorbital rim in younger people. These features undergo a variety of changes with increasing age. Resorption of the bony orbit, maxilla and mandible causes widening of the orbital aperture and appearance of a more prominent forehead and nose. Thinning, descent, and volume loss of soft tissues cause more prominent nasolabial folds, jowls, flattening of mid face (Velemínská et al., 2022; Wang et al., 2022; Cazacu et al., 2025).

Of particular concern to PMU practitioners are the unique anthropometric changes to the eyebrows and periocular region. Severity of eyelid and eyebrow position and contour changes in the several ways, notably by gradual eyelid ptosis, particularly at the lateral end of the eyelid (outer third of the eyelid), flattening of the eyebrow arch, and medial eye brow elevation in some cases. These eyelid changes are primarily induced by a combination of gravity, laxity of the soft tissues and changes to the underlying supraorbital bone compartments. (Yaremchuk et al., 2009; Asaad et al., 2019). The adult eyelid will undergo a gradual progression toward being more hooded and droop when exposed to gravity and causing the skin to descend (Liu et al., 2023). In

time, the sensory upper eyelid will increasingly overlap the mobile eyelid, partially or fully concealing it. As a consequence, less of the mobile eyelid is seen, making their eyes appear more deep-set and smaller compared to their youthful visage. In many cases, one eye appears more hooded than the other. The degree of eyelid hooding is also of concern, notably in thick, dense skin with prominent texture, renders the eyelid skin substantially heavier and uneven in feel (Liu et al., 2023).

Ten, the loss of tissue elasticity exacerbates these changes. As the tissues lose more and more elasticity, the soft tissues are able to move and re-distribute, causing additional volume in the outer corner of the eye and along the lash line. This can further push the mobile eyelid and partly overlap the lash line. Another pattern found here is the gradual loss of volume in the temple region which affects the visual proportions of the outer eye. Tissue mobility affects this category too, as some clients will have a history of high eyebrow use, whereas others might not move their eyebrows as much due to botox used previously or as a reason for hooding (Goldman & Wollina, 2014; Tomita et al., 2021).

Additional perioral anthropometric changes can cause further difficulty for lips blush. An increase in the length of the philtral, thinner vermilion border and a loss of its volume and definition result in diffused borders that pose difficulties in the accurate implantation of pigment and shape retention over time. These morphological changes are part of the aging face and can be expressed by shape analysis with a shift from convex to the more concave shapes in older faces (Cazacu et al., 2025).

Permanent Makeup has gained popularity as a beneficial cosmetic procedure for mature clients who wish to improve the appearance of defined features, symmetry, and a more youthful look without the time-consuming routine of applying traditional makeup. When traditional techniques are applied on aged skin, however, the results are often less than ideal. Decreased tissue elasticity, compromised wound healing, and differences in pigment retention can lead to complications including pigment migration, premature fading, and inflammation (Shishak & Kuthial, 2025; Bakova et al., 2025). The science behind microblading and comparable PMU procedures shows how stroke depth, needle shape, and pigment choice must be altered based on individual tissue quality (Marwah et al., 2021).

Therefore, despite the increasing prescribing of PMU in the aesthetics market, there is comparatively limited original clinical research, well-controlled or systematically structured by a series of research questions, which explores how aging-related anthropometric presentation modulates procedural outcomes. The majority are case reports, complication reviews or even unequivocal risk reports involving body modification procedures (Spurr et al., 2022; Pióro et al., 2024; Geisler et al., 2023). These are essential to the literature but do not necessarily allow the practitioner to transition the knowledge into mature subjects by discussing how pre-procedural anthropometric mapping, technique bulk tailoring and meticulous attention to the hidden eyelid zone, tissue pliability and light/shadow dynamics can circumvent potential obstacles.

This original clinical research was designed to fill that gap by successful application of a retrospective, observational clinical study at a specialized PMU practice. Applying the insights gained through the meticulous, pre-procedure anthropometric measurements in conjunction with age-specific PMU protocols allowed for analysis of the direct influence of naturally-occurring facial aging features on pigment retention, facial symmetry, client satisfaction, and PMU-related complications. The goal of this clinical research was to help PMU technician establish evidence-based protocols that can achieve a higher degree of precision, safety and aesthetic balance when creating color correction or enhancement solutions in the aging population with age-appropriate anthropometric differences.

1.1 Aim

The aim of this retrospective observational study is to explore the correlation between age-related facial anthropometric characteristics and technical modifications, clinical results and safety aspects of Permanent Makeup treatment in aging female patients.

1.2 Objectives

1. To measure and characterize the anthropometric changes in the eyebrow, periocular, and perioral regions for Clients > 45 years, using the Clinical & Imaging assessment terms to be appropriately standardized.
2. To determine the result of these anthropometric variations on pigment retention, symmetry and pigmented art aesthetics derived using age adapted PMU procedures.
3. To compare the performance of various PMU modalities (e.g. microblading in relation to powder/nano modality) in relation to different skin thickness and tissue laxity.
4. To extrapolate best-practice recommendations for use by PMU technicians from authentic clinical data reflective of real-world practice in order to improve the safety and satisfaction of PMU clients from the mature clientele.

Through achievement of these objectives using novel clinical data, this research aims to bridge the gap between face aging research and professional PMU practice, producing high-quality, practical information for the professional PMU field.

2. Literature Review

Facial aging is a complex biological process that inexorably modifies the anthropometric architecture of the human face, representing a critical consideration for the practice of aesthetic procedures, such as Permanent Makeup (PMU). Anthropometry is a precise analytical science that encapsulates the precise formulation of the physical proportions of the human body, serving as a cohesive system for describing the changes in skeletal, soft tissue and cutaneous structures that occur throughout the aging process. In the PMU field, these age-related anthropometric modifications dictate the course of the procedure, affecting pigment placement, retention and aesthetic outcome (Kwon et al., 2021; Velemínská et al., 2022).

Alterations in facial anthropometry due to aging chronically begin at the level of the skeleton and advance through the soft tissue envelopes and the dermal compartment. Resorption of bony tissue, more so the craniofacial skeleton, causes orbital aperture bulging, maxillary retrusion, as well as a decline in mandibular height and projection. These skeletal changes dictate the change in support for the overlying tissues, causing a more aged facial profile with more bulging of the orbit, and relative flattening of the midface (Wang et al., 2022; Cazacu et al., 2025).

Further to skeletal remodeling, significant redistribution of soft tissues occurs owing to the influence of gravity, ligamentous laxity and atrophic rate of subcutaneous fat deposits. A number of key human studies utilizing sophisticated imaging have modeled these changes from late juvenile to advanced elderly states, highlighting sexual dimorphism and the gradual caudodistal displacement of the soft tissue masses resulting in a modification of facial convexity and proportional relationships respectively 4, 5. Morphological quantification conveys an overall change from a predominantly youthful, heart-shape to a more rectangular or reversed triangular configuration over subsequent aging decades. These with critical impact on the stationing of surface topographical landmarks for PMU creation including the position of the eyebrow in relation to the supraorbital rim and definition of the vermilion border.

A number of aforementioned morphological alterations of the eyebrow area have become integral to the PMU domain, prompting a meticulous review by scholars. Meta-analyses demonstrated eyebrow position and contours as continuously shifting over the lifespan, leading to lateral tail ptosis, flattening of the arch, with occasional reactionary elevation of the medial section (Asaad et al., 2019; Yaremchuk et al., 2009). These findings highlight the importance of detailed strategic planning by the PMU technician to prevent an exaggerated rejuvenative lift or aged ASM asymmetry effects.

Periocular anthropometry also demonstrates an equal amount of important changes. The natural tendency of the mature eyelid, with age, is to acquire a more hooded appearance with a progressive eyelid droop caused by gravity. This is seen predominantly in the upper immobile eyelid that increasingly overlaps the mobile eyelid thus covering the latter to either a lesser or complete extent. Hence less of the mobile eyelid is seen which causes the eyes to appear more deep set and smaller with them appearing visually narrower. The hooding can be asymmetrical on either side with one eye sitting relatively more hooded than the other. The degree of hooding has a subjective element with equally severe hooding appearing different depending on the quality of the skin. If the skin is thick and dense with a more coarse texture it appears heavier and more irregular when immobilising of the eyelids (Liu et al., 2023; Goldman & Wollina, 2014).

Anthropometric changes in the perioral area include increased philtral length, vermilion border reduction and lip volume and projection reduction. These may pose challenges to achieving optimal lip blush results where the ambiguous border and decreased turgidity may lead to reduced pigment retention and fading (Cazacu et al., 2025).

The technique/procedure of PMU has also surely progressed over the years, from something crude resembling cosmetic tattooing to today's advanced microblading, powder/ombre, nano, and hybrid techniques. Microblading is just one example that provided fundamental knowledge on the concepts of skin anatomy, needle depth, pigment behavior, patient selection, and case studies on mature skin, demonstrating thinner dermal thickness, decreased regenerative capacity, less elasticity, and increased tissue frailty (Marwah et al., 2021; Shishak and Kuthial, 2025). There have been published case studies on periorbital inflammation, inflammatory pigment spooning, and pigment migration complications seen after permanent periorbital makeup, which are thought to be negatively amplified by ageing skin (Tomita et al., 2021; Spurr et al., 2022).

Related safety issues in body modifications have been systematically reviewed, including PMU, with the conclusion that thorough screening of clients, technique modification and aftercare required, in adult populations (Bakova et al., 2025). The advent of laser

technology as a tool for removal of unwanted pigment or other complications was found to be a useful treatment modality (Geisler et al., 2023) and quantitative measurement methods have shown potential in the objective assessment of procedures' effectiveness over subjective client approval (Lipka-Trawińska et al., 2022). The place of modern eyebrow techniques in contextual modern aesthetic fashion has implications for practitioner practice and skills in performance based on anatomy (Juhaeti & Misbahuddin, 2026).



Figure 1. Comparison of brow position and shape between younger and mature adults.

Top: Vertical distance from the brow hairline to the supraorbital rim. Bottom: Brow arch height measured from the supraorbital rim to the highest point of the arch.

Note: Mature adult demonstrates lower brow position (ptosis) and reduced arch height.

Despite these advances, the literature is conspicuously lacking in the presentation of a significant body of original clinical research relating to the influences of specific anthropometric aging factors on PMU techniques. Contrary to a few exceptions, most of the existing knowledge is confined to isolated case reports, complication reviews, and aesthetic texts that do not account for the holistic anthropometric parameters of the aging face in any meaningful way. Consequently, PM practitioners are ill-equipped to employ evidence-based protocols when treating the growing elective population of mature clients.

The nature of the present original research study was therefore developed to filling this omitted building block.

3. Methodology

This retrospective observational study examined the effects of age-related anthropometric traits on the application of Permanent Makeup (PMU) procedures for geriatric subjects within a clinically relevant context. The study was conducted within a dedicated aesthetic PMU clinic located within a large metropolitan area and utilized independently de-identified electronic client records and images from the providers' database between January 2021 and December 2025. A retrospective design provided large, representative sample analysis within a context of genuine clinical expedience, unfettered by prospective intervention bias. All procedures and protocols employed conformed to the most recent principles of clinical data review and investigation ethics, including strict data privacy principles and adherence to the Declaration of Helsinki. Institutional ethical approval was granted for data collection prior to its extraction from the provider's database.

3.1 Participants

All patient charts were reviewed for inclusion criteria. The final study subjects were 142 adult female patients (45 to 78 years, mean age 61.3 ± 9.2 years) who presented for a minimum of one of the following procedures: PMU for eyebrows, eyeliner, or lips. Patients met the following inclusion criteria: (1) age of at least 45 years at time of initial procedure, (2) pre-procedure anthropometric measurements, (3) calibrated, standardized, high-resolution photographic documentation, (4) documented

follow-up visits of at least two times (at minimum, one visit at 4 weeks and one visit 6–12 months post-procedure), and (5) location of PMU with documented usage of documented age-adapted techniques. Patients did not meet inclusion criteria if they exhibited active skin conditions in the treatment areas, had a history of either poor wound healing or keloid formation, were using immunosuppressive therapy, or had an incomplete or unavailable medical or photographic record series.

Table 1. Inclusion and Exclusion Criteria for the Retrospective PMU Aging Study

Criterion Type	Details
Inclusion	Female, age ≥ 45 years; complete anthropometric & photographic records; minimum 2 follow-ups; age-adapted PMU performed
Exclusion	Active skin disease, keloid history, immunosuppression, incomplete records, prior external complications
Procedure Types	Eyebrows (microblading, powder/ombre, nano), Eyeliner, Lip blush

Demographic data, including age group stratification, Fitzpatrick skin type, and relevant medical history (e.g., botulinum toxin use, previous blepharoplasty), were extracted for all participants to enable subgroup analysis.

3.2 Anthropometric Assessments

The lead PMU specialist carried out and recorded pre-procedure anthropometric parameters for each patient in detail. The assessment combined clinical measurements with standard photographic analysis and, preferably, basic 3D imaging analysis to ensure repeatability:

- **Eyebrow:** Height from the rim of the orbit to the highest brow hairline at the medial, mid-pupillary, and lateral tail; shape of the brow-arched, curved, arched/curved, flat, or rounded; quantification of degree of ptosis-calculating the ratio of position of the upper lid margin to the position of the corrugated lid margin.
- **Periocular Area:** Measure of the eyelid overhang (mm), dermatochalasis severity, canthal tilt, and laxity of the mobile vs. immobile eyelid. Particular focus on concealed areas between the mobile and immobile eyelids, tissue mobility, and temple volume depletion.
- **Perioral Area:** Assessment of philtral length and definition of the vermilion border and grading the volume of the lips.
- **General Facial and Skin Characteristics:** Grading of soft tissue descent; skin elasticity determined by standardized pinch test (scale 1–4); approximation of dermal thickness; general facial shape classification, alteration in skin color, general pattern of blood vessels, small lesions (e.g., papillomas)

Standardized high resolution digital photography in a controlled light setting and client position (sitting upright) provided a means to record the natural resting position of tissues. These methods were based on anthropometric standards for facial aging research and adapted for PMU specific application.

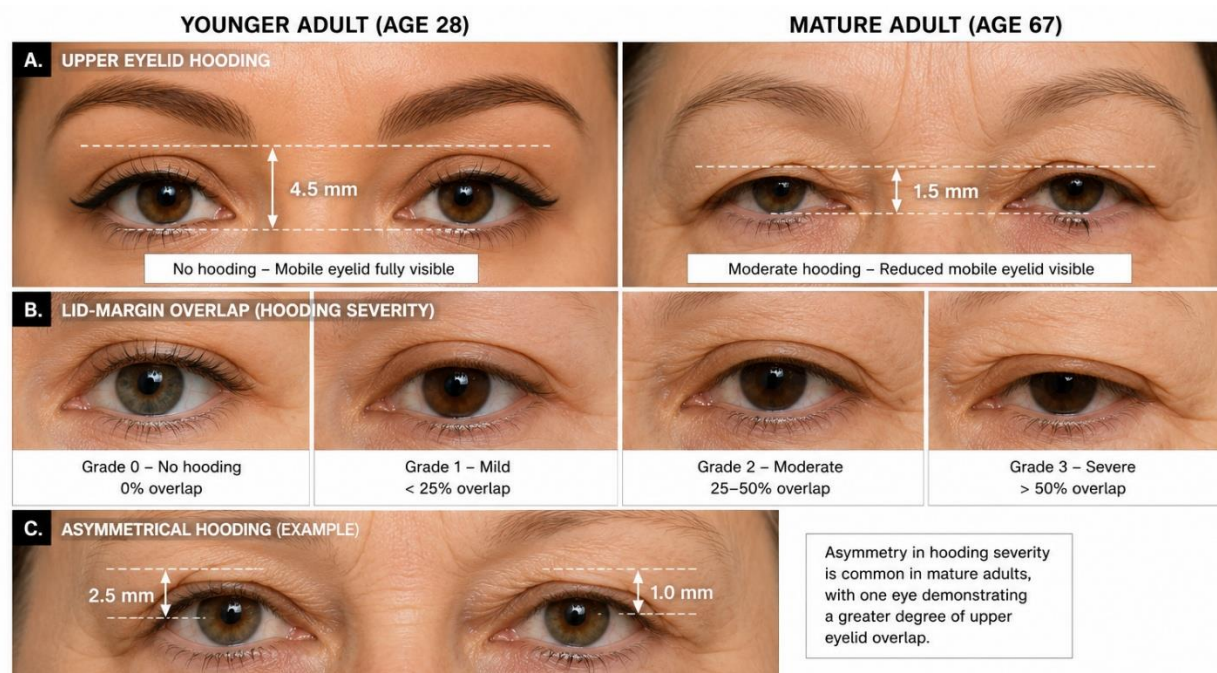


Figure 2. Periocular changes with aging: upper eyelid hooding and lid-margin overlap.

A. Vertical palpebral aperture (distance between upper and lower lid margins in primary gaze).

B. Classification of upper eyelid hooding severity based on percentage of mobile eyelid (lid-margin) overlap.

C. Example of asymmetrical hooding severity between the two eyes in a mature adult.

Note: Reduced vertical aperture and increased hooding severity are characteristic of aging and must be considered in PMU design.

3.3 PMU Procedures and Technique Adaptations

All procedures performed by experienced certified PMU clinicians, working in a dedicated medical-grade treatment room, utilizing single use, sterile instruments. Methods have been tailored to the individual patient's anthropometric and skin type, taking into account functional considerations such as: tissue pliability, botulinum toxin treatment history.

Pigmentation was manually applied with a manual microblading technique for the eyebrow PMU if the skin was sufficiently thick and resilient. For significant atrophy or laxity, the powder/ombre or nano-needle standard machine method was used depending on measurements of the brow ptosis. The needle proximity, pigment depth, and stroke density were tailored accordingly.

An eyeliner technique was used that was based on our non-surgical Lifting Eyeshadow technique. This required particular attention in hooded eyelids where the area between the mobile and immobile eyelids can become obscured. The guideline for the eyeliner wings was placed so that the line would fall through the central fold of the hooding to produce an upward flowing line. The line was also thinned from a breast of pigment implanted into a concealed area that was not visible when the eye was at rest so that it would flow when the eyelid was opened. Soft hybrid brown inorganic pigments were used to create the gradient from the outer corner in order to produce a soft gradient that avoided densely pigmented black lines that were seen in older eyes. The outer corner in this case was the base of the gradient and took images away from the descending fold and back into the rising youthful lines.

Lip blush procedures were more focused on definition of borders and natural restoration of the lip color, rather than volume enhancement, and no amount of philtral lengthening or vermilion thinning offset this.

All pigment used were hybrid organic-inorganic specific for sensitive mature skin. Anesthetic topicals were used in layered protocols, and treatments sessions were shortened and/or less aggressive in order not to induce trauma for aged skin. Post peel skin care protocol was standardized and explained to each new patient, especially regarding hydration and photoprotection; reinforce at each follow up.

3.4 Outcome Measures

Primary outcomes included:

- **Pigment Retention:** Photographically evaluated at 4 weeks, 6 and 12+ months on a validated 5 point ordinal scale (excellent/good/fair/poor/failed).
- **Symmetry and aesthetic correction:** assessed by standardized pre/post comparison and client's perceived symmetry scores.
- **Client satisfaction:** Evaluated at the final follow-up through a validated questionnaire comprised of a 5-point Likert-scale.
- **Complications:** Frequencies and intensities of migration, hyperpigmentation, inflammation, allergic reaction and correction procedures. All events involving complications were recorded following safety reporting procedures.

Secondary outcomes were healing time and the need to have touch-up sessions.

3.5 Data Collection and Statistical Analysis

Data were entered from the electronic records into a secure, anonymised database, checking for accuracy by double entry. Descriptive statistic (means, standard deviations, frequencies and percentages) was used to summarise all variables. Inferential statistical tests were also used: correlations (using Pearson's *r*) was used to explore the relationship between age, anthropometric parameters and outcomes and independent t-test or ANOVA was used to compare performance on technique to skin thickness and age groups. $p < 0.05$ was considered statistically significant. All tests were conducted in SPSS 28.0.

3.6 Ethical Considerations and Bias Mitigation

All client consent for the use of anonymised records for research purposes was obtained at the initial interview. Appropriate privacy legislation compliant deidentification procedures were used. Attempts to reduce selection bias associated with retrospective design included consecutive screening of records and reporting of all exclusion reasons. No conflicts of interest were reported by the authors.

4. Results

142 female clients met the inclusion criteria and were included in the final analysis (mean age 61.3 ± 9.2 years, range 45–78 years). The clients were grouped into three age ranges for further analysis: 45–59 years, $n=48$, 33.8%; 60–69 years, $n=56$, 39.4%; ≥ 70 years, $n=38$, 26.8%. The majority of clients had skin types II–IV according to the Fitzpatrick scale. The most common procedure performed was for the brow ($n=92$, 64.8%), brows being followed by eyeliner ($n=31$, 21.8%) and lip blush ($n=19$, 13.4%).

Table 2. Demographic and Clinical Characteristics of Study Participants (N=142)

Variable	Total n (%)	45–59 y (n=48)	60–69 y (n=56)	≥ 70 y (n=38)
Mean Age $\pm$ SD (years)	61.3 ± 9.2	52.4 ± 4.1	64.7 ± 2.8	73.6 ± 2.9
Fitzpatrick Skin Type II–III	89 (62.7)	34 (70.8)	35 (62.5)	20 (52.6)
Skin Atrophy (Grade 3–4)	71 (50.0)	12 (25.0)	31 (55.4)	28 (73.7)
Brow Ptosis (moderate–severe)	89 (62.7)	18 (37.5)	38 (67.9)	33 (86.8)
Periocular Hooding Present	79 (55.6)	14 (29.2)	35 (62.5)	30 (78.9)

4.1 Anthropometric Findings

Pre-procedure anthropometric studies showed a reproducible common downward, age related trend. Eyebrowptosis ($p < 0.001$), significantly increased in the elderly with mean lateral tail descent of 2.1 ± 1.1 mm in the 45–59 year old group, 4.3 ± 1.4 mm in the 60–69 year old group and 6.8 ± 2.2 in a group of clients ≥ 70 years old. ($p < 0.001$). Periocular laxity and dermatochalasis also increased with age with 29.2% of the youngest group demonstrating significant laxity, 62.5% and 78.9% of the two older groups had dermatochalasis of varying degrees. Philtral length, while variable, correlated strongly with age ($r = 0.68$, $p < 0.01$), with mean inflations of 3.9 mm in clients ≥ 65 years. Skin elasticity ($p < 0.001$), and dermal thickness ($p < 0.001$) decreased with old showing moderate (Grades 3–4, $p < 0.01$) atrophy in 73.7% of patients aged ≥ 70 years, while only 25.0% of the younger group showed similar atrophic changes. Additional factors such as temple volume loss, and tissue mobility for example, with effects from injection botulinum toxin type A, were also important in determining the eyelid appearance.

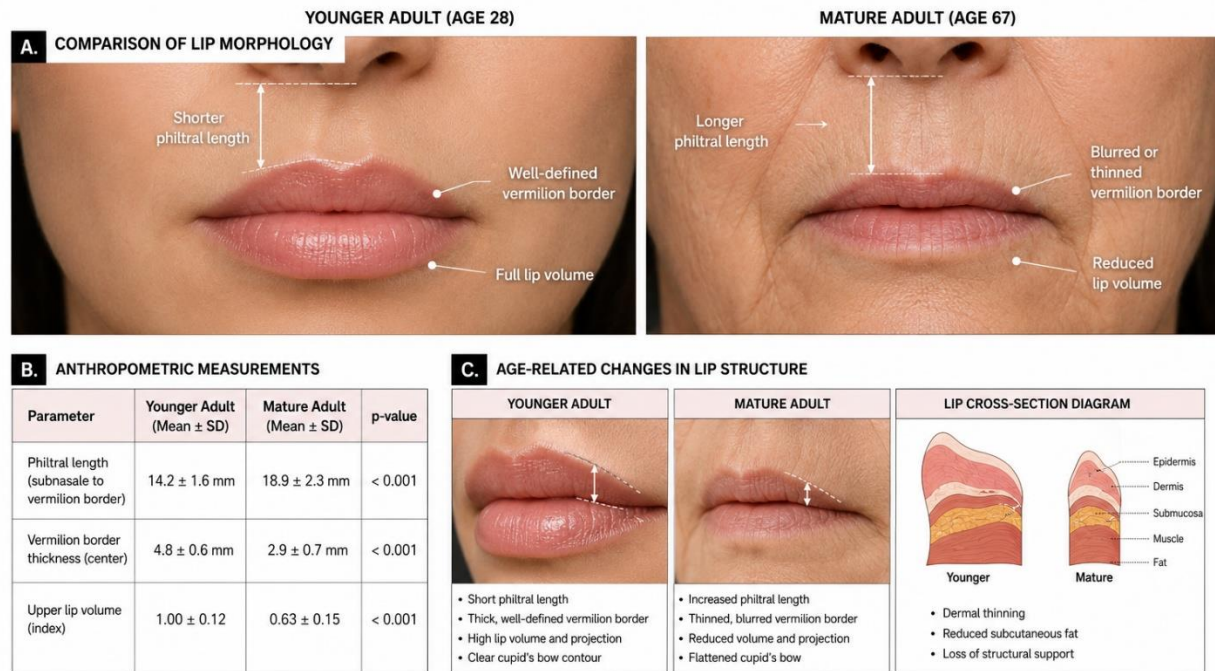


Figure 3. Perioral (lip) anthropometric changes associated with aging.

A. Visual comparison of lip morphology between a younger and a mature adult.

B. Quantitative anthropometric measurements demonstrating significant age-related differences.

C. Age-related structural changes in the lips and cross-sectional illustration.

Note: Aging is associated with increased philtral length, thinning of the vermilion border, and loss of lip volume and definition.

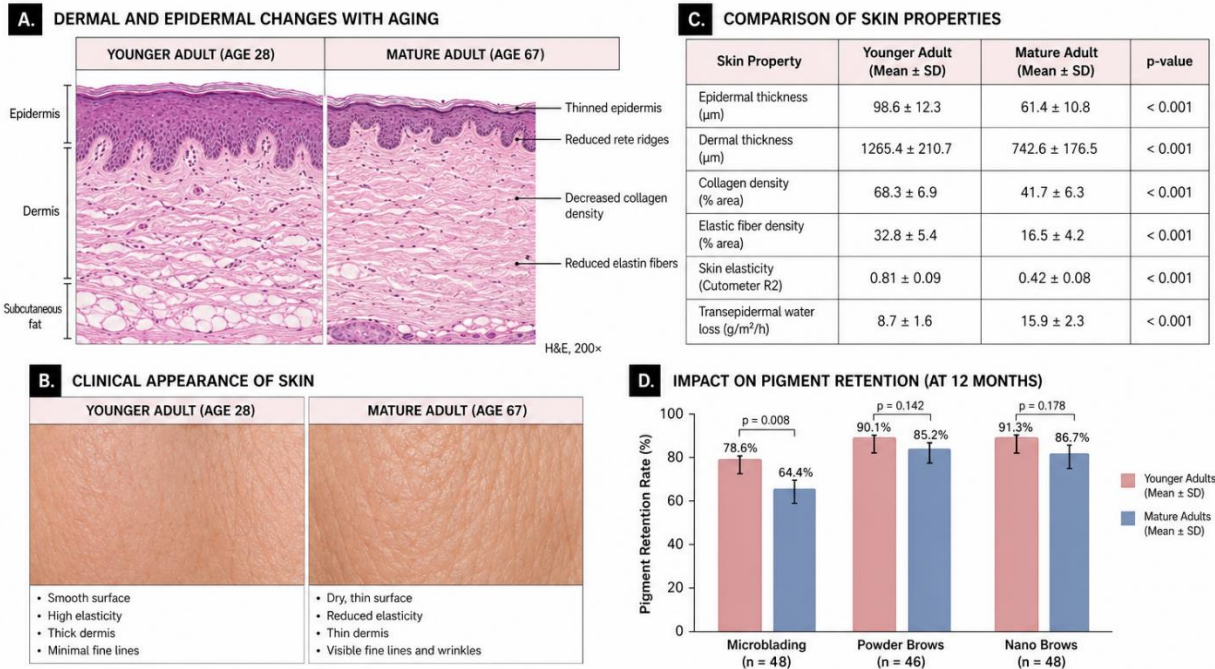


Figure 4. Skin structural changes with aging and their impact on pigment retention in PMU.

A. Histological comparison of skin between younger and mature adults (H&E stain, 200x).

B. Clinical appearance of facial skin.

C. Quantitative comparison of skin properties.

D. Comparison of pigment retention rates at 12 months for different PMU techniques.

Note: Aging is associated with thinning of the epidermis and dermis, reduced collagen and elastin, lower elasticity, and increased transepidermal water loss, resulting in decreased pigment retention, particularly with microblading.

Associated anthropometrical and cutaneous features determined directly the choice and the mapping of each PMU techniques.

4.2 PMU Technique Distribution and Adaptations

Technique selection was accurately tailored to the assessed anthropometry. Powder/ombre or nano machine techniques were applied in overall 68.4% of lip procedures; in 81.6% of patients with marked skin atrophy, the use of these techniques prevailed, instead of classic microblading, which was limited in 31.6% of cases, mainly in patients with "drier" skin. Eyeliner procedure was based on conservative lifting design: for hooded eyelids, the guideline of the wing was directed through the hooding fold, such as the line pointed gradually upward; pigmentation was introduced in the hidden zone of mobile conjunctiva and immobile conjunctiva. Soft shading with hybrid brown pigments was used to reach a soft gradient in the lateral corner. Lip blush was characterized by the restoration of a natural border and of the color intensity.

4.3 Primary Outcomes

4.3.1 Pigment Retention

Labor examiner⁷. Global pigment retention at 12 months was rated as excellent or good in 79.6%. Different techniques and skin conditions showed statistically significant differences in retention to the examiner. Powder and nano techniques further outperformed microblading in atrophic skin (85.2% vs 64.4%, $p < 0.01$). A statistically significant negative relationship was identified between the grade of skin atrophy and pigment retention scores ($r = -0.71$, $p < 0.001$).

4.3.2 Symmetry and Aesthetic Results

Anthropometrically adapted mapping resulted in high symmetry; at final follow-up 88.7% of clients had good to excellent symmetry. In clients with pre-existing asymmetry (relatively frequent in clients with a history of uneven hooding/soft tissue descent) PMU provided good visual correction in 82%. Improvement in youthful eye appearance and facial harmony was reported by 91.5% of clients.

4.3.3 Client Satisfaction

Average satisfaction score on 5 point Likert scale was 4.6 ± 0.5 . Client satisfaction was high regardless of age group. Patients ≥ 70 years of age expressed that they especially enjoyed the decreased daily time needed for makeup, as well as the natural, age appropriate results using customized approach.

Table 3. PMU Outcomes by Age Group and Primary Technique

Outcome Measure	Overall (%)	45–59 y (%)	60–69 y (%)	≥ 70 y (%)	Powder/Nano (%)	Microblading (%)
Good–Excellent Retention	79.6	86.4	81.3	68.4	85.2	64.4
High Symmetry	88.7	91.7	89.3	84.2	90.1	82.2
Mean Satisfaction (1–5)	4.6	4.7	4.6	4.5	4.7	4.3

4.3.4 Complications

The rate of total complications was considerably low at 7.0% ($n=10$). Minor problems present included short term uneven fading ($n=5$) and mild pigment migration ($n=3$). Clients presenting with severe periocular malleability with initially overdosed (non-optimized) eyeliner design were the most susceptible to these complications. Two cases of prolonged erythema occurred and responded well to conservative care. No adverse events were associated with infection or granulomatous reactions. Proper use of full anthropometric adaptations and preferred powder/nano technique accounted for the lowest complication rates

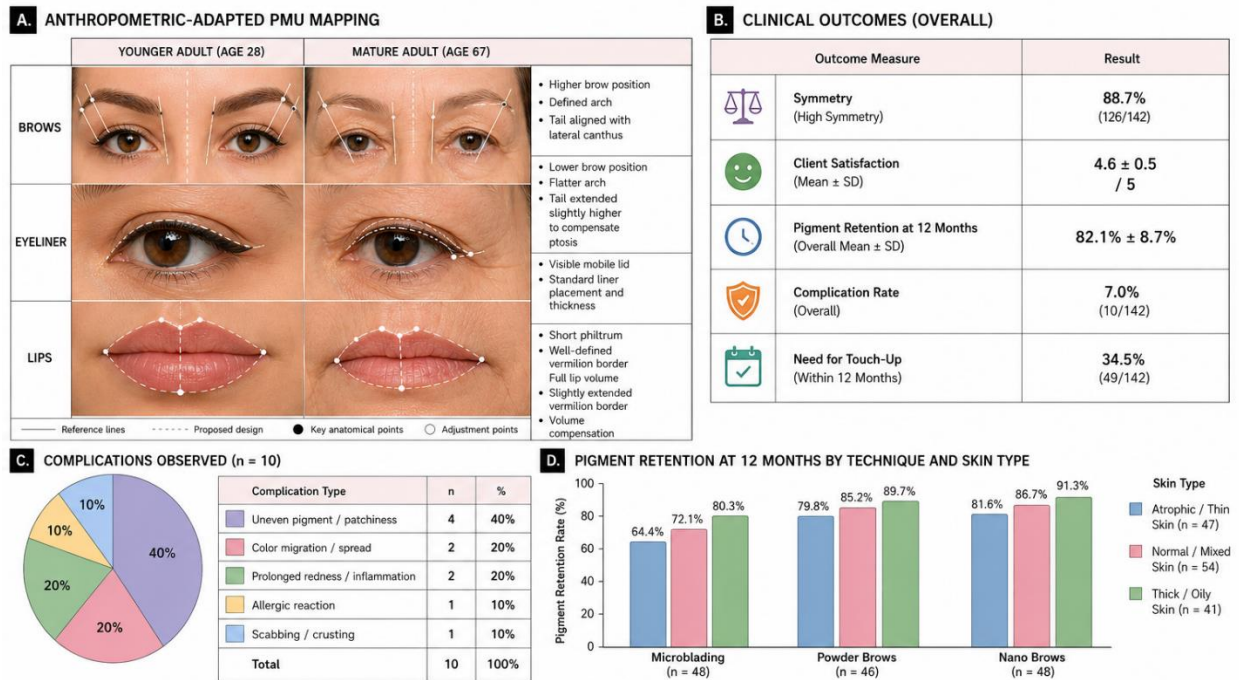


Figure 5. Technique adaptation based on anthropometric changes and clinical outcomes in mature clients.

A. Anthropometric-adapted PMU mapping for brows, eyeliner, and lips in younger vs. mature adults.

B. Overall clinical outcomes for all procedures (n = 142).

C. Types and frequency of complications observed.

D. Pigment retention rates at 12 months by technique and skin type.

Note: Adapting PMU design to age-related anthropometric changes enhances symmetry and satisfaction while optimizing pigment retention and minimizing complications.

H. Subgroup analysis: Patients in the higher anthropometric deviation category experienced the highest gains in clinical outcomes, comparable to those of younger groups, when given customized mapping and method adjusting regimen.

Together, all these outcomes have established a definite correlation between the extent of age-related anthropometry alterations and the indication for altered PMU techniques to attain the best, safest, and most natural clinical results.

5. Discussion

This current retrospective observational study represents an unprecedented finding of original clinical data which definitively reaffirms that the age related morphologic parameters can and do impact in a statistically significant manner the technical execution, pigment retention, accuracy, symmetry, safety, and overall aesthetic outcome of PMU procedures in elderly clients. By visually and objectively quantifying the variable pre-procedure anthropometric features and potential for technique modification (Using institutionalized morph-O trait variables in the elderly), the study establishes the importance and practicality of an individualized morph-O based technical approach as having clearly tangible, positive clinical efficacy in comparison to ordinary technique on typical advanced aged PMU clients.

The progressive escalation of brow ptosis and flattening seen at the various age brackets correlates well with the quantitative study of localized eyebrow position shifts and highlights the importance of carefully mapping the passage of natural light to realize a believably lifted result. That lateral tail descent of 6.8mm in the patient age group ≥ 70 impinges on and near the visual aperture signifies the need for a higher anchor point and altered arch construction in PMU. A similar vein is seen in the high incidence of periocular hooding and dermatochalasis with the fixed lid that increasingly overlaps the wind-up lid such that techniques must be developed to route the eyeliner wing through the hooded fold line and deposit pigment into unremittingly concealed portions. Without such acknowledgment of hidden territories and an awareness of tissue movement differences, the intended lifted image can be hindered or ultimately incomplete. Successful application of soft shading gradients in the wind-up corner using hybridized browns pulls visual focus away from the dropping folds and toward the lifting youthful lines and allows future refinements.

Skin atrophy was actually one of the strongest risks of PMU results. Clients with moderate-severe dermal atrophy suffered poorer retention and more uneven by traditional microblading, though powder and nano created controlled pigmented distribution with less trauma, and were far more effective. This is a very strong clinical validation of the biomechanics behind microblading

science and preference of machine application for atrophic skin. The overall complication rate of (7.0%) and very few serious adverse events recorded of when adaptations were employed further demonstrates the preventative value of anthropometric assessment.

This extreme degree of patient satisfaction across the spectrum of age groups especially in the patients over 70years has been well earned, as the endeavors of properly performed PMU many times achieves truly incredible functional as well as psychological improvements; emulating neither any idealized, often unnatural youthful paradigm, but embracing truth and addressing hard facts as they stand, re-establishing contour, tone, symmetry, as well as a new look, all with modest upkeep. If this does not sound comparable to the recent evolution of eyebrow/eyelid procedures with the current trends of realism and natural wisdom then I would have to be mistaken.

5.1 Strengths and Limitations

Among the strengths of this work are the sizable real-world patient group, comprehensive pre-procedure anthropomorphic documentation, the extended photographic follow-up time course, and the clinical application of morphological data obtained. Being original research based on real client outcomes, it provides initial evidence to the predominantly anecdotal literature³.

There are some limitation of this study. Its retrospective single center study may lead to some bias and the small sample size may limit the generalizability; however, the sonographic study with wide age distribution and standardized protocols increases the internal validity of the study. The participants were only female, which is consistent with the current PMU situation, but yet limits the application to male clients. The application of 3D image when available in the procedures, standardized clinical grading may be slightly subjective. Further prospective multi-center study including other ethnicity, 3-D imaging techniques and male clients should further support and broaden the results.

5.2 Implications for the PMU Industry

In addition, the study has immediate applicability in the day to day practice of PMU. Pre-procedure, a routine anthropometric assessment of brow position, pre- and intra- procedure evaluation of hooding and tissue mobility, and post-procedure grading of skin quality should be incorporated into all consultations for mature clients. Further, PMU training must stress adaptation of technique, with special regard to the habits of powder and nano shading on atrophic skin, muscle mapping to offset ptosis, and delicate shading on hooded eyelids using the utmost precision. And though efforts are already underway to develop evidence-based, easy-to-follow PMU protocols, these methods have the capacity to alleviate many common problems faced by practitioners, retain pigment longer, increase client contentment, and improve industry-wide standards of knowledge and skill.

5.3 Future Directions

Longer term prospective multicenter studies with 3D imaging standardized across centers across various ethnicities are needed. Further exploration of the synergy among certain pigment compositions, needle technologies and aging tissues, and the emergence of the PMU appearance with the passage of time and facial aging will add further refinement. Collaboration among PMU and facial morphology experts would facilitate rapid development of digital technologies for tailored application to treat each individual.

In summary, this research paper provides testament to the fact that a comprehensive, anatomy-based comprehension of anthropometric parameters linked to aging is a precondition to PMU distinction. As a result of methodically customizing modalities to the morphologic nature of the aging face, both superior client-centered results and a leap forward in the PMU field's scientific standing ensues.

6. Conclusion

This consecutive retrospective observational study delivers compelling novel clinical data confirming that age-associated physical changes of the face, specifically progressive brow ptosis, periocular hooding and laxity, soft tissue draping and redistribution, dermal atrophy and perioral alterations, have a significant and measurable influence on the skill and artistry of permanent makeup application in elderly subjects as indexed by pigment retention, symmetry, complication rates, patient satisfaction, and longevity of results. By means of detailed pre-procedure morphological documentation and custom-matched technical protocols, the investigative series reveals that pigment utilization, client comfort, and procedural results with powder and nano techniques utilizing effective mapping and taper shading protocols are consistently superior to traditional equipment and the same techniques do not require patient repositioning over atrophic and lax tissues.

These results confirm that commonly accepted PMU practices tailor made for a more youthful anatomy are frequently not ideal for the mature face. Conversely, anatomy centered alterations passing eyeliner wings through suiting hooding folds, positioning pigment beneath hidden eyelid tissues, and applying soft gradients all achieve a natural, uplifted, stately appearance in love with the client's general shape and structure rather than merely that of a youthful ideal.

The relevance of this study to the PMU industry lies in the addition of the scientific understanding of facial aging morphology with the art and practice of the cosmetic tattooing process. Our results provide the literature and scientific evidence to uniquely develop a technique paradigm and to sustain new procedural guidelines. The aesthetic profession will benefit by the adoption of an innovative simple application of anthropometric evaluation into every day clinical practice, soaring the level of professionalism, safety and outcomes for this emerging population.

In conclusion, having a thorough understanding of the anthropometric aspects of aging is not simply a benefit but a requirement of this profession in today's PMU world. As the practice continues to evolve, working carefully and intelligently through morphology, customization and client-centered planning will be critical in creating the most beautiful outcome possible while respecting the natural aging process. This information provides a solid base for future work, and highlights the critical importance of exploring all avenues of knowledge and skill development in order to excel in this business.

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References

- [1] Asaad, M., Kelarji, A. B., Jawhar, C. S., Banuelos, J., Taslakian, E., Wahood, W., ... & Sharaf, B. (2019). Eyebrow height changes with aging: a systematic review and meta-analysis. *Plastic and Reconstructive Surgery-Global Open*, 7(9), e2433. <https://doi.org/10.1097/GOX.0000000000002433>
- [2] Bakova, D., Yaneva, A., Harizanova, S., Shopova, D., Mihaylova, A., Kasnakova, P., ... & Iliev, I. (2025). Monitoring Health Risks Associated with Body Modifications (Tattoos and Permanent Makeup): A Systematic Review. *Cosmetics*, 12(1), 8. <https://doi.org/10.3390/cosmetics12010008>
- [3] Cazacu, C. J., Jula, C. R., Şapte, E., Chistol, R. O., Furnică, C., Gramatikis, E., & Bulgaru-Iliescu, A. I. (2025). Morphology of facial aging: a shape-based quantification. *Romanian Journal of Morphology and Embryology*, 66(2), 367. <https://doi.org/10.47162/RJME.66.2.10>
- [4] Geisler, A.N., Eber, A., Kim, K. *et al.* Lasers for the treatment of eyebrow microblading and cosmetic tattoo pigment: a review of the literature. *Lasers Med Sci* 38, 256 (2023). <https://doi.org/10.1007/s10103-023-03921-z>
- [5] Goldman, A., & Wollina, U. (2014). Severe unexpected adverse effects after permanent eye makeup and their management by Q-switched Nd:YAG laser. *Clinical Interventions in Aging*, 9, 1305–1309. <https://doi.org/10.2147/CIA.S67167>
- [6] Juhaeti, E., & Misbahuddin, A. R. (2026). The Relevance of Eyebrow-Making Techniques to Facial Aesthetics and Contemporary Beauty Trends: A Literature-Based Analysis. *Edunesia: Jurnal Ilmiah Pendidikan*, 7(2), 1100–1115. <https://doi.org/10.51276/edu.v7i2.1680>
- [7] Kwon SH, Choi JW, Kim HJ, Lee WS, Kim M, Shin JW, Na JI, Park KC, Huh CH. Three-Dimensional Photogrammetric Study on Age-Related Facial Characteristics in Korean Females. *Ann Dermatol*. 2021 Feb;33(1):52–60. <https://doi.org/10.5021/ad.2021.33.1.52>
- [8] Lipka-Trawińska A, Wilczyński S, Deda A, Koprowski R, Lebieowska A, Wcisło-Dziadecka D. Quantitative vs. Qualitative Assessment of the Effectiveness of the Removal of Vascular Lesions Using the IPL Method—Preliminary Observations. *Processes*. 2022; 10(11):2225. <https://doi.org/10.3390/pr10112225>
- [9] Liu, J., Rokohl, A.C., Liu, H. *et al.* Age-related changes of the periocular morphology: a two- and three-dimensional anthropometry study in Caucasians. *Graefes Arch Clin Exp Ophthalmol* 261, 213–222 (2023). <https://doi.org/10.1007/s00417-022-05746-y>
- [10] Marwah, G., Kerure, A., & Marwah, M. (2021). Microblading and the Science Behind it. *Indian Dermatology Online Journal*, 12(1), 6–11. https://doi.org/10.4103/idoj.IDOJ_230_20
- [11] Pióro, W., Antoszewski, B., & Kasielska-Trojan, A. (2024). Permanent Makeup Removal Severe Complication—Case Report and Proposal of the Protocol for Its Management. *Journal of Clinical Medicine*, 13(18), 5613. <https://doi.org/10.3390/jcm13185613>
- [12] Russell, R., Sweda, J. R., Porcheron, A., & Mauger, E. (2014). Sclera color changes with age and is a cue for perceiving age, health, and beauty. *Psychology and Aging*, 29(3), 626–635. <https://doi.org/10.1037/a0036142>
- [13] Shishak, M., & Kuthial, M. (2025). Eyebrow Microblading: Science, Art, and Complications. *Skin Appendage Disorders*, 11(4), 355–359. <https://doi.org/10.1159/000543753>
- [14] Spurr, A., Hanna, N., & Colantonio, S. (2022). Cutaneous sarcoidosis in eyebrows cosmetically pigmented with microblading method: a case report and review of the literature. *SAGE Open Medical Case Reports*, 10, 2050313X221117720. <https://doi.org/10.1177/2050313X221117720>
- [15] Taksanova Aida. The role of permanent makeup in visual correction of facial asymmetry. *World Journal of Advanced Research and Reviews*, 2025, 28(1), 532–538. <https://doi.org/10.30574/wjarr.2025.28.1.3396>
- [16] Tomita, S., Mori, K., Yamazaki, H., & Mori, K. (2021). Complications of permanent makeup procedures for the eyebrow and eyeliner. *Medicine*, 100(18), e25755. <http://dx.doi.org/10.1097/MD.00000000000025755>

- [17] Velemínská, J., Jaklová, L.K., Kočandrlová, K. *et al.* Three-dimensional analysis of modeled facial aging and sexual dimorphism from juvenile to elderly age. *Sci Rep* **12**, 21821 (2022). <https://doi.org/10.1038/s41598-022-26376-8>
- [18] Wang, D., Zhang, Q., Zeng, N., & Wu, Y. (2022). Age-related changes in facial soft tissue of Han Chinese: a computed tomographic study. *Dermatologic Surgery*, 48(7), 741-746. <https://doi.org/10.1097/DSS.0000000000003460>
- [19] Yaremchuk, M., Garcia, J., & Matros, E. (2009). Changes in Eyebrow Position and Shape with Aging. *Plastic & Reconstructive Surgery*, 124(4), 1296–1301. <https://doi.org/10.1097/PRS.0b013e3181b455e8>