

ANALYSIS OF THE IMPACT OF INVASIVE PROCEDURES ON EYEBROW MORPHOLOGY: CHALLENGES AND ORIGINAL APPROACHES TO AESTHETIC RESTORATION

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Abstract. The article presents a comprehensive analysis of changes in eyebrow morphology caused by invasive procedures and introduces original methods of aesthetic restoration that address current challenges in cosmetology and plastic surgery. The aim of the study is to examine the specific features of morphological transformations of the eyebrows resulting from invasive interventions and to develop an adaptive, original approach to their aesthetic correction. The study employed general scientific methods of cognition: analysis, synthesis, induction, deduction, comparison, generalization and systematization. The results demonstrate that eyebrow morphology is a combination of anatomical and aesthetic characteristics, including shape, positioning and proportions, which determine the harmony of their appearance within the overall facial structure. Key parameters were outlined, such as the positions of the medial and lateral ends of the eyebrow, the height and location of the arch peak, and the orientation relative to anatomical landmarks (medial and lateral canthus, nasal ala, limbus, corners of the eyes and lips). These characteristics are influenced by age, gender, and ethnicity, which means that aesthetic standards require an individualized approach. The study revealed that surgical interventions and botulinum toxin injections significantly transform eyebrow morphology, helping to achieve aesthetically desirable outcomes such as elevation of the lateral edge, a more harmonious arch shape, and proportionate positioning of the eyebrow in relation to the face. Despite their high effectiveness, these procedures present several challenges: the lack of a universal ideal eyebrow shape, shifting beauty standards, variability based on individual facial features, and the requirement for a high level of practitioner expertise. It is emphasized that excessive standardization can result in the loss of facial individuality. Therefore, an original correction approach is proposed, based on the principle of individualization – particularly relevant in cases of facial asymmetry. The author's technique considers sociocultural trends, the patient's aesthetic expectations, and modern concepts of harmony, allowing the preservation of authentic appearance. The practical significance of the study lies in the development of an adaptive model for aesthetic eyebrow correction that combines anatomical precision with a personalized approach to each patient.

Keywords: eyebrow morphology; invasive procedures; aesthetic correction; anatomical landmarks; individualization.

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Introduction

Today, eyebrow correction has become as common a procedure as a manicure. Nearly every woman performs some kind of regular eyebrow treatment. While in some cases these are routine cosmetic procedures, others involve invasive interventions that directly affect eyebrow morphology. Eyebrow morphology itself is shaped by standards dictated by fashion trends. However, current practice shows that globalization and the rapid development of mass media and social networks have significantly altered perceptions of beauty. As a result, women around the world are influenced by foreign aesthetic models that often do not align with the traditional features or cultural characteristics of a given region [3].

Thus, what is fashionable is not always universally attractive or appropriate. Trends change beauty ideals quickly. One of the key responsibilities of specialists working with eyebrow morphology is the ability to distinguish between what is merely fashionable and what genuinely suits the patient's individual features. It is crucial to constantly update outdated aesthetic perceptions in order to meet contemporary demands. At the same time, it is essential to adhere to unchanging principles: avoid harm, maintain natural facial proportions, follow technical standards of invasive procedures, ensure maximum safety for the patient, and achieve results that are not only aesthetically justified but also meet client expectations.

Literature Review. To date, there is a considerable body of research dedicated to eyebrow structure, particularly in relation to achieving harmony between the eyebrows and both facial features and current beauty trends. It is becoming increasingly clear that eyebrows and their shape are components of beauty standards influenced by factors such as age, gender and fashion.

Initial scientific studies in this field date back to 1974. M. Westmore explored various eyebrow models and shapes, noting that both the medial and lateral ends of the eyebrow should lie on the same horizontal line to ensure facial harmony. The medial end should align with a vertical line passing through the nasal ala and medial canthus, while the lateral end should be positioned along a line extending from the nasal ala to the lateral canthus. The eyebrow arch, in turn, should align with a vertical line drawn from the lateral limbus [9].

Further exploration of eyebrow morphology by G. Angres in the 1980s led to the identification of a new arch position based on the interocular distance. The author highlighted gender-based morphological differences: men typically have straight eyebrows with no prominent arch, whereas in women, the arch is usually located between the middle and outer third of the eye. He emphasized that the arch should be more lateral – above the lateral canthus. These conclusions were drawn after analyzing hundreds of photographs of attractive faces, supporting Westmore's original model [1].

However, other researchers argued that the arch position does not always need to follow Westmore's model precisely. A new concept of standards was proposed in 2016 by E. Yalçinkaya, C. Cingi, and H. Soken. Their analysis of contemporary photographs revealed that the medial and lateral ends of the eyebrow and the arch position can vary. They found that the medial end is positioned less medially than the line connecting the nasal ala and medial canthus, and the arch is located more laterally than the lateral limbus. However, the authors did not propose a new integrated model and limited their findings to factual observations based on extensive photographic analysis [10]. It can be stated that there is no single standard for ideal eyebrow shape, and existing models used in practice are not consistent over time.

Beyond morphological studies, a significant number of works have examined invasive influences, particularly plastic surgery procedures aimed at altering facial appearance by reshaping the eyebrows. J. Roth and S. Metzinger concluded that the eyebrow arch should lie between the lateral limbus and the lateral canthus, while Wolford suggested that the arch

should be located midway between these two points. In 2003, Roth and Metzinger became the first to provide an objective, quantitative assessment of this parameter [8].

More than 50 years have passed since these early studies, and eyebrows are now viewed not only as anatomical features but also as morphological structures with detailed parameters. Numerous studies have shown that eyebrow morphology can be influenced by a wide range of factors, particularly age, gender and ethnicity. Based on this, the current study is limited to women of the European descent aged 18–35. The main objective is to create an accurate and up-to-date eyebrow model based on morphological principles established in recent years.

The aim of the article is to highlight the risks of invasive procedures and their impact on eyebrow morphology under the influence of various factors.

Research results

Eyebrows play an important role in communication and human perception. They express a wide range of emotions such as sadness, anger, satisfaction, and joy. Since the early stages of human civilization, eyebrows have been recognized as a key component in the aesthetic structure of the face. As early as the 18th century, art historian Johann Winckelmann reconsidered ancient Greek concepts of beauty, noting that eyebrows are not simply graceful arches above the brow ridge. They reflect a person's mood, define character, and indicate what can be expected from them. He also observed that, at that time, eyebrows fused in the middle – forming a single line – were considered especially attractive. This medial feature, known as synophrys, is now regarded as unaesthetic. This demonstrates that eyebrows reflect certain aspects of beauty trends related to both male and female appearance [7].

To illustrate the changes in eyebrow morphology and aesthetics, an objective assessment of the M. G. Westmore model from the period 1965–1975 will be provided, followed by a comparison with the past decade.

The position of the eyebrow arch, as well as the medial and lateral ends, has undergone changes over the past 70 years. Previously, the medial end was positioned along a vertical line passing through the medial canthus. When applying the Westmore model to contemporary fashion models, it was found that the medial end has shifted further medially – by an average of 4.66 mm relative to the medial canthus. To accommodate this shift, the lower end of the vertical line that previously passed through the medial canthus was repositioned toward the oral commissure. The line passing through the oral commissure and medial canthus also proved relevant for the group of women of European descent.

The lateral part of the eyebrow should be slightly higher than the medial part. However, in the group of women of European descent, the lateral end was located on the same horizontal line as the medial end, consistent with Westmore's description. Similar results were obtained by Roth J. M. and Metzinger S. E. (2003), although they were unable to determine the precise vertical placement of the lateral end in the model group. Due to discrepancies between the results for models and non-models, it is important to maintain a horizontal alignment of the eyebrow ends. For both models and non-models, the lateral end lies along a tangent line passing through the lateral nasal ala and the lateral canthus, so this line remains part of the Knoll model.

The arch peak has shifted laterally by 5.78 mm during the studied period. Currently, it lies along a tangent line that passes through the lateral limbus and intersects the oral commissure. The accuracy of this line is important for models and European women.

In a 2023 article, Mason R. described a technique for intraoperative reconstruction of the eyebrow peak based on the Westmore model. This line serves as a useful and practical guide for determining the direction of tension vectors when shaping the eyebrow. Although the model described in 2023 scientific literature has been verified using modern models and

women of European descent, it will likely undergo modifications in the future and may require adjustments within the next 20–30 years. The results of objective measurements are presented in Table 1.

Table 1 – Eyebrow morphology

Parameter	1970s models	Contemporary models
A (medial displacement)	–0.79 mm	+4.66 mm
B (height of the lateral end)	+1.71 mm	+0.07 mm
C (position of the arch peak)	+5.78 mm	+5.84 mm
D (arch height above the medial end)	+4.15 mm	+3.38 mm

Eyebrow morphology is a combination of anatomical and aesthetic characteristics related to the shape, positioning, and proportions of the eyebrows, which determine their appearance within the overall facial structure. It includes parameters such as the position of the medial and lateral ends of the eyebrow, the height and location of the arch (peak), as well as the orientation of the eyebrow relative to facial anatomical landmarks – the medial and lateral canthi, nasal alae, limbus, and oral commissure.

Understanding eyebrow morphology is especially important when it concerns not just cosmetic correction but invasive procedures. In the past decade, eyebrow shaping procedures have grown significantly in popularity, driven by the development of tools and techniques. Surgical or botulinum brow lifts are methods aimed at recreating the ideal eyebrow shape. The precise placement of the eyebrow arch plays a key role in the overall aesthetic appeal of the face. Models that help predict the ideal position of the arch are particularly useful during such procedures.

In a 2023 study, Mason R. defines invasive procedures as medical interventions that involve penetrating body tissues through surgical incision, injection, or the use of specialized instruments. In the context of aesthetic medicine, the author identifies two types of invasion:

Surgical brow lift – a plastic surgery procedure that alters the eyebrow position by excising tissue and fixing it in a new location;

Botulinum toxin injections (Botox) – a minimally invasive procedure that temporarily paralyzes facial muscles, resulting in elevation of the outer part of the eyebrow [6].

Invasive procedures can significantly modify eyebrow morphology to align with current aesthetic standards. Most of them relate to three types of interventions:

First, changing the position of the eyebrow arch. Modern beauty standards require the peak of the eyebrow arch to be placed more laterally than in the classical Westmore model. Invasive interventions allow for precise recreation of this laterally shifted peak, especially through the use of external tissue tension vectors during surgery.

Second, adjusting eyebrow height through surgical or injection-based methods allows for lifting the lateral end of the eyebrow, resulting in a more expressive, “open” gaze and a rejuvenated facial appearance.

Third, unifying proportions using anatomical landmarks, such as the line running from the lateral limbus to the oral commissure, serves as a reliable guide during invasive eyebrow modeling.

In summary, invasive procedures are an effective tool for correcting eyebrow morphology in accordance with evolving aesthetic standards. They allow for precise control of the arch position, adjustment of its height, and repositioning of the medial and lateral ends, thereby recreating the desired eyebrow shape that harmonizes with the overall facial architecture.

An analysis of research on invasive eyebrow correction procedures shows that such practices are not entirely risk-free for women. As noted in the 2024 study by Mac Quillan A.,

most challenges involve anatomical-functional and aesthetic aspects, as well as the changing nature of beauty ideals. Based on information gathered from various sources, key challenges of invasive eyebrow correction are summarized in Table 2.

Table 2 – Key challenges of invasive eyebrow correction

No	Key aspect	Challenge
1	Lack of a universal eyebrow shape ideal	Risk of generalizing models without accounting for ethnic, age, and gender variations, which may lead to results that do not meet patients' expectations based on their phenotype.
2	Subjectivity of aesthetic ideals	Long-term consistency of results may be compromised as trends change, causing eyebrow morphology to no longer align with future aesthetic standards.
3	Accurate reproduction of anatomical landmarks	High precision is required in clinical practice, especially in cases of facial asymmetry or age-related soft tissue changes.
4	Risks of complications and side effects	Possibility of complications such as bleeding, swelling, over- or under-correction, asymmetry, and damage to facial muscles, which may require further interventions.
5	Dependence on tissue tension vector	Difficulty in controlling the trajectory of eyebrow elevation due to dependence on tissue tension direction; requires precise use of anatomical reference lines.

It can be concluded that invasive procedures for eyebrow morphology correction offer a powerful tool for achieving aesthetic results, but they are accompanied by a number of challenges that must be considered and weighed before making a decision. It should also be noted that effective invasive practice requires an individualized approach, which can only be built on extensive experience working with people of different ages and racial backgrounds. In their study, Erol, O. O., Sozer, S. O., and Velidedeoglu, H. V. emphasize the importance of a personalized approach to refining eyebrow shape. The authors point out that classical anatomic-geometric models, despite their popularity, do not always align with current aesthetic standards and cannot be universally applied to every face type. In those situations—when formulas do not work – there is a need for authorial approaches based on individualization and artistic-anatomical analysis.

The authors state that individualization is always the foundation of a personalized approach. This principle is essential to invasive procedures, where instead of strictly following standard lines – such as vertical axes or reference points associated with the nasal ala – the geometry of the eyebrow is adapted to the individual face, considering proportions, interocular distances, and muscular dynamics. In such cases, the use of dynamic anatomical reference lines becomes important, for example, the line that passes through the lateral limbus and the oral commissure, which takes into account not only static anatomy but also facial expressiveness.

Second, it is necessary to consistently consider current beauty models and ideals. These standards tend to change approximately every ten years, so relying on general norms in the context of aesthetic invasion – when there is no clinical necessity – may be ineffective. Beauty that is considered ideal today may appear disproportionate or outdated in just a few years, especially under the influence of mass media, fashion trends, and pop culture. Therefore, it is essential to continually verify existing models and standards based on current beauty canons within a relevant control group, particularly considering racial characteristics, which highlights the clinical adaptability of the approach.

Third, it is important to stress that any standard tends to depersonalize the face. For aesthetic correction to emphasize individual features, models must not only be regularly verified but also updated. The authors emphasize that proper eyebrow morphology is variable, and the ideal arch can differ in height and location depending on a person's anatomy and desired outcome. This is especially relevant in surgical interventions, where planning must account not only for geometric references but also for facial muscle symmetry or asymmetry, age-related soft tissue changes, patient expectations, and face shape (oval, square, triangular, etc.). Flexible modeling of tension vectors during invasive procedures can produce significantly better aesthetic results than the use of standardized models and protocols.

In cases where anatomic-mathematical formulas do not yield aesthetically satisfying results, the specialist must rely on aesthetic intuition – the ability to align eyebrow shape with the overall appearance of the face, emotional expression, and age. This becomes especially relevant in restoring or correcting eyebrows in patients after trauma, asymmetry, or oncological surgery.

In summary, authorial approaches to eyebrow morphology are based on recognizing the limitations of standard models and formulas in aesthetic medicine. Their essence lies in individualization, adaptation to modern aesthetic norms, flexibility in clinical planning, and a combination of anatomical precision with artistic vision. These approaches make it possible to achieve the optimal eyebrow shape in cases where formulas fail.

Conclusions. Based on the analysis conducted, several key conclusions can be drawn. Eyebrow morphology consists of anatomical and aesthetic characteristics that include the shape, positioning, and proportions of the eyebrows, which define their appearance within the overall structure of the face. These parameters include the placement of the medial and lateral ends of the eyebrow, the height and location of the arch (peak), and the orientation of the eyebrow in relation to anatomical landmarks such as the medial and lateral canthi, nasal ala, limbus, eyes, and oral commissure.

Eyebrow morphology is influenced by many factors, including age, gender, and ethnic background. Therefore, it is important to recognize that eyebrow shaping standards may differ for different women and that these standards go beyond routine cosmetology – they become especially significant during invasive procedures. Such procedures include surgical brow lifts, as a form of plastic surgery, and botulinum toxin injections, which are minimally invasive and allow for changes in the positioning of specific eyebrow areas.

Invasive interventions have the potential to significantly influence eyebrow morphology by adapting it to contemporary aesthetic norms. They allow for the elevation of the lateral eyebrow end, proportional unification, and correction of the arch position. However, it is necessary to remember that these procedures have lasting effects and therefore involve a number of challenges that may impact patient satisfaction. These include the absence of a universal ideal eyebrow shape, which changes approximately every decade; the subjectivity of aesthetic ideals, which are not fixed and depend on various sociocultural factors; and the fact that not all standardized models are harmonious for every face type. Additionally, the accurate reproduction of anatomical landmarks requires a high level of expertise, and invasive procedures must be performed exclusively in professional clinical settings to minimize the risk of complications and side effects.

At the same time, it should be emphasized that the key to successful invasive correction lies in individualization. Authorial methods are used precisely when standards and mathematical models fail – especially in cases of facial asymmetry. It is also necessary to consider current models, standards, and beauty ideals, and most importantly, the specific goals and objectives of the procedure. Any standard has the tendency to depersonalize the face. Therefore, to preserve individual features, morphology standards must be adjusted and made adaptive, so that the face remains expressive and the person recognizable.

References

1. Angres, G. G. (1985). Blepharopigmentation and eyebrow enhancement techniques for maximum cosmetic results. *Annals of Ophthalmology*, 17, 605–611. URL: <https://pubmed.ncbi.nlm.nih.gov/4073713/>
2. Erol, O. O., Sozer, S. O., & Velidedeoglu, H. V. (2002). Brow suspension, a minimally invasive technique in facial rejuvenation. *Plastic and Reconstructive Surgery*, 109(7), 2521–2532; discussion 2533. DOI: <https://doi.org/10.1097/00006534-200206000-00054>
3. Hwang, K., & Yoo, S. K. (2016). Eyebrow shapes over the last century. *Journal of Craniofacial Surgery*, 27, 2181–2184. URL: <https://pubmed.ncbi.nlm.nih.gov/28005785/>
4. Kim, S. K., Cha, S. H., Hwang, K., et al. (2014). Brow archetype preferred by Korean women. *Journal of Craniofacial Surgery*, 25, 1207–1211.
5. Mac Quillan, A. (2024). Brow lift risks and complications. URL: <https://anthonymacquillan.com/blogs/brow-lift-risks-and-complications/>
6. Mason, R. (2023). Types of brow lift surgery: A guide. *La Femme*. URL: <https://lafemmeps.com/the-popularity-of-the-brow-lift-in-zoom-culture-2/>
7. Matsushita, S., Morikawa, K., Mitsuzane, S., et al. (2015). Eye shape illusions induced by eyebrow positions. *Perception*, 44, 529–540. DOI: 10.1068/p7823
8. Roth, J. M., & Metzinger, S. E. (2003). Quantifying the arch position of the female eyebrow. *Archives of Facial Plastic Surgery*, 5, 235–239 URL: <https://www.liebertpub.com/doi/10.1001/archfaci.5.3.235>
9. Westmore, M. G. (1974, May 7). Facial cosmetics in conjunction with surgery. Paper presented at the Aesthetic Plastic Surgical Society meeting, Vancouver, BC, Canada.
10. Yalçinkaya, E., Cingi, C., Soken, H., et al. (2016). Aesthetic analysis of the ideal eyebrow shape and position. *European Archives of Oto-Rhino-Laryngology*, 273, 305–310. DOI: <https://doi.org/10.1007/s00405-014-3356-0>