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# DEVELOPMENT OF STANDARDIZED PROTOCOLS FOR EYEBROW SHAPE CORRECTION IN POST-TRAUMATIC AND POST-PROCEDURAL DEFORMITIES: AUTHOR'S CONTRIBUTION TO THE ADVANCEMENT OF AESTHETIC REHABILITATION

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***Abstract.*** *The article focuses on developing unified protocols for eyebrow shape correction in cases of deformities caused by trauma or unsuccessful aesthetic procedures, with an emphasis on the author's concept within the field of aesthetic rehabilitation. The aim of the study is to examine the features of creating and applying standardized eyebrow correction protocols in the context of post-traumatic and post-procedural deformities, and to define the author's approach as a new stage in the evolution of aesthetic rehabilitation. The research involved general scientific methods of cognition: analysis, synthesis, comparison, systematization, modeling, and clinical observation. The results demonstrate that successful aesthetic reconstruction of eyebrows stems from a combination of standardized protocols and an individual approach to each clinical case. It was determined that the specialist's task goes beyond restoring the lost contour and includes creating a new eyebrow shape that harmoniously integrates with the overall facial aesthetics. The proposed protocol outlines a logical sequence of steps: from assessing scar tissue condition, vascularization, and defect zone morphology to selecting donor material, forming graft channels, and defining aesthetic landmarks for each individual eyebrow. Particular attention is paid to anatomical differences between genders, age-related changes, and facial typology, ensuring clinical relevance and safety of the method. A key focus of the author's approach is the idea of individualization. It has been shown that no algorithm or mathematical model can fully encompass the range of aesthetic and physiological parameters unique to each patient. Even precise morphometric measurements require adjustment based on intercanthal distance, facial muscle activity, skin thickness, periorbital relief, and the patient's subjective perception of desired aesthetics. The practical significance of this study lies in the creation of an adaptive clinical toolset applicable in aesthetic medicine to improve eyebrow reconstruction outcomes in complex cases.*

***Keywords:*** *aesthetic rehabilitation, eyebrow correction, post-traumatic deformities, individualization, clinical protocol.*

## Introduction

In the current context of rising popularity of aesthetic procedures, especially in cosmetology and minimally invasive dermatology, there has been a significant increase in cases of iatrogenic facial contour deformities, particularly in the eyebrow area. Procedures involving botulinum toxin, fillers, hardware methods (lasers, RF lifting, ultrasonic SMAS), chemical peels, and aggressive permanent makeup can result in deformities, asymmetry, hair loss, or disruption of the natural skin texture in the eyebrow region. These changes often have both aesthetic and psycho-emotional consequences and require comprehensive correction. In addition to procedural trauma,

mechanical injuries, burns, surgical interventions, oncological resections, autoimmune and infectious lesions remain relevant causes, typically resulting in scarring and localized alopecia. Given the complex anatomy of the periorbital zone, any intervention affecting the eyebrow shape must carefully consider both functional and aesthetic factors. Traditional reconstruction approaches, such as local skin flaps, transposition flaps, dermabrasion, or tattooing, often yield unstable or unnatural results. This study emphasizes the most physiological and long-lasting method – hair autotransplantation – as the primary tool for restoring the shape and density of eyebrows following post-traumatic and post-procedural deformities.

The issue of developing standardized protocols for eyebrow shape correction in post-traumatic and post-procedural deformities has been widely explored in international scientific literature. Significant contributions to this field include the work of J.C. Alex [1], who emphasized the aesthetic aspects of brow lifting, laying the foundation for understanding facial aesthetic harmony. S.B. Baker [2] investigated how eyebrow shape influences facial perception, which is crucial in rehabilitation after trauma or unsuccessful procedures. J. Chen and colleagues [3] proposed a unified surgical procedure for eyebrow restoration in cases of scarring deformities, serving as a model of standardization in clinical practice. S.B. Cho [4] introduced an innovative approach to eyebrow restoration in scleroderma using autologous fat transplantation, expanding the possibilities in restorative dermatology. As early as 1983, R. Ellenbogen [5] noted the effectiveness of combining transcoronal brow lift with blepharoplasty, thus initiating a comprehensive approach to upper facial correction.

The studies of R.M. Graf [6] and J.P. Gunter [7] focused on anatomical and functional analysis of eyebrows. A. Karacalar [8] described compensatory eyebrow asymmetry, which often complicates standardization of techniques, though his clinical experience provides valuable guidance for case-specific adaptation.

Recent methods, such as the use of botulinum toxin for eyebrow correction, are presented in the work of M. Khattar [9], demonstrating predictable outcomes in complex cases. At the same time, B.I. Knoll [10] and J. Kunjur [11] highlighted how changes in the forehead and periorbital area influence facial expressions, an important

consideration in post-traumatic rehabilitation. Finally, E. Yalçınkaya [13] proposed an aesthetic model of ideal eyebrow positioning, which can serve as a foundation for developing standards.

Despite the abundance of literature on this topic, there remains a lack of systematized material directly related to the subject of this study. Therefore, using various methods of scientific inquiry, the available information has been analyzed, categorized, and presented in the context of the research theme.

**Purpose of the article**

The aim of the article is to highlight the specific features involved in developing standardized protocols for eyebrow shape correction in post-traumatic and post-procedural deformities, with a focus on the author's contribution to the advancement of aesthetic rehabilitation.

**Research results**

In cosmetology practice, post-traumatic and post-procedural deformities in the eyebrow area are common occurrences that require an individualized approach to correction. These deformities disrupt the aesthetic harmony of the face, may cause psychological discomfort, and negatively affect the quality of life of patients. Post-traumatic deformities typically result from external injuries to the skin and underlying tissues, such as cuts, burns, blunt trauma, or surgical interventions in the forehead and eyebrow region. Scarring, hair loss, or tissue displacement often lead to asymmetry or distortion of the natural eyebrow contour [4]. In contrast, post-procedural deformities arise from poor-quality or excessive aesthetic interventions. These include poorly executed permanent makeup, asymmetrical filler injections, complications after laser pigment removal, or incorrectly performed surgical procedures [2]. These conditions are often accompanied by hyperpigmentation, scarring, or hair loss.

The need to establish standardized correction protocols is driven by the high frequency of such clinical cases and the necessity of ensuring predictable, safe, and aesthetically satisfactory treatment outcomes. The formation of standard procedures for managing such cases is based on analyzing the experiences of practitioners and researchers in the field. A review of international scientific literature shows that many

studies focus on protocol-based or standardized eyebrow reconstruction depending on the clinical context.

**Table 1** – Protocol for eyebrow correction in post-traumatic and post-procedural deformities

| Step | Parameters/Criteria | Recommendations and actions | Sources |
|---|---|---|---|
| 1. Initial assessment | Type of deformity (trauma, scar, surgery). Facial shape, gender, age, and ethnic features are taken into account | 1) Identify asymmetry, volume loss, or hair loss; 2) Perform aesthetic analysis based on established guidelines | Westmore M.G. [12], Ellenbogen R. [5] |
| 2. Scar assessment | Scar type: superficial, hypertrophic, keloid, atrophic | 1) Superficial: transplantation possible without preparation; 2) Hypertrophic: corticosteroid injections until softened; 3) Keloid: surgical excision, potential graft bed deficiency; 4) Atrophic: angled implantation, consider fat injections | Chen, J. [3], Karacalar A. [8] |
| 3. Vascular assessment of tissue | Perfusion, stability, vascularization | 1) Use morphological imaging if possible; 2) Alternatively, assess tissue density/softness subjectively | Kunjur J. [11] |
| 4. Eyebrow shape planning | Assessment based on gender, face type, intercanthal distance | 1) Women: arched brow peaking above lateral limbus; 2) Men: straighter, flatter brow with lower arch; 3) Adjust eyebrow position considering intercanthal distance | Westmore M.G. [12], Chen, J. [3] |
| 5. Donor material selection | Hair diameter and color; donor site (scalp, beard, legs) | 1) Use trichoscopy for matching; 2) Avoid thick or curly hairs to maintain a natural look | Knoll B.I. [10] |
| 6. Local anesthesia | 2% lidocaine + 0.1% epinephrine | 1) Inject into superficial dermis (≤1.5 ml per area); 2) Apply compress and ice for 5 minutes before infiltration | |
| 7. Graft channel creation | Insertion angle, density, depth | 1) Normal tissue: 5–10°; 2) Scar tissue: 10–20°, lower density; 3) Thick fatty bed: smaller angle, reassess graft distribution in 6 months | |
| 8. Graft implantation | Hair direction, diameter, color | 1) Medial part: lighter, finer hairs; 2) Lateral part: darker, denser; 3) Implant from edges toward center while maintaining symmetry | |
| 9. Post-procedural assessment | Appearance, symmetry, density | 1) Patient self-assessment; 2) Plan potential correction in 6–12 months | |
| 10. Alternative approaches | Stable scars, contractures | 1) Fat grafting (stromal vascular fraction) as a preparatory stage; 2) Surgical release in cases of ectropion or adhesions | Graf R.M. [6] |

For instance, Chen J and other authors studied eyebrow reconstruction in cases of damage and deformity caused by burns, facial trauma, and other types of skin injuries in the eyebrow area. They note that in patients with unilateral eyebrow defects, the reconstructed eyebrow is designed to match the preserved contralateral eyebrow. In cases where the contralateral eyebrow is sparse or aesthetically unsatisfactory, additional procedures to increase hair density and improve eyebrow shape were performed [3]. In patients with bilateral eyebrow defects, reconstruction took into account individual characteristics of facial symmetry [3].

The development of an aesthetic rehabilitation standard for the eyebrow area, aligned with contemporary aesthetic principles, is based on a protocol-driven sequence of steps carried out by the specialist. This includes not only selecting a harmonious eyebrow shape but also a full range of preparatory, diagnostic, and operative procedures. Based on the analysis of various studies, the following is a generalized protocol sequence for eyebrow correction in post-traumatic and post-procedural deformities.

The foundation of the standard lies in clinical relevance and safety: starting from thorough medical history collection, tissue condition and scar evaluation, and ending with the selection of a specific intervention technique – reconstructive, injection-based, or combined. This approach ensures not only visually appealing outcomes but also long-term stability and a reduced risk of complications.

It is also important to emphasize that not all damaged areas are suitable for eyebrow reconstruction. As noted by Cho S.B., Roh M.R., and Chung K.Y. [4], restoration protocols vary depending on scar type. Scar types are classified as superficial, hypertrophic, atrophic, and keloid.

- Superficial scars are soft, allowing for uncomplicated hair transplantation in those areas.
- Hypertrophic and keloid scars have dense consistency and rise above the skin surface, making it difficult to implant hair at a uniform depth. Hypertrophic scars can be pre-treated with corticosteroids [3]. Keloid scars often require surgical excision, though this can result in insufficient tissue for transplantation [3].

- Atrophic scars require graft implantation at an acute angle due to the shallow graft bed.
- Dense (rigid) scars can be softened beforehand with glucocorticoids or autologous fat grafts [3].

In this context, eyebrow shape serves a purely aesthetic function and is determined individually—taking into account gender, age, ethnicity, facial morphotype, eye positioning, facial expression patterns, and skin structure.

Five basic eyebrow shapes have been identified:

- curved,
- sharp angled,
- soft angled,
- rounded,
- flat [1].

In general, sharp angled brows suit individuals with round faces; rounded brows are suitable for heart-shaped faces; and flat brows are ideal for long faces. All eyebrow shapes are acceptable for oval face types [1].

In men, eyebrows typically have a straight, horizontal shape and are classified as “sword-shaped” brows. These brows are usually thick, wide, and almost always straight, without a pronounced arch or with only a slight elevation [9]. In women, the brow arch is typically more pronounced. On average, the width of the brow peak measures about 1 cm in men and 0.8 cm in women, while the length and overall width of the eyebrow are approximately 5.5 cm and 0.8 cm in men, and 5 cm and 0.6 cm in women [3].

The medial brow edge is vertically aligned with the alar base of the nose. The brow arch is located along a line drawn from the center of the nose through the center of the pupil, while the lateral brow edge corresponds to the point where a line from the lateral canthus intersects the outer edge of the same side of the nose. The distance from the center of the pupil to the peak of the brow ranges from 2 to 2.5 cm [3].

Although the position of the brow head, tail, and peak was determined using these parameters and reference lines, they were not considered fixed and could be adjusted

based on individual preferences and facial structure.

Figure 1 shows the ideal eyebrow shape in both men and women [9]. In women, the medial edge of the eyebrow begins on the same vertical plane as the lateral edge of the nasal ala and the inner corner of the eye (point A). The lateral edge is located along a diagonal line drawn from the lateral edge of the nasal ala through the outer corner of the eye (point B). The medial and lateral parts of the eyebrow are approximately aligned horizontally, although the lateral portion may be elevated by 10–20 degrees relative to the medial side.

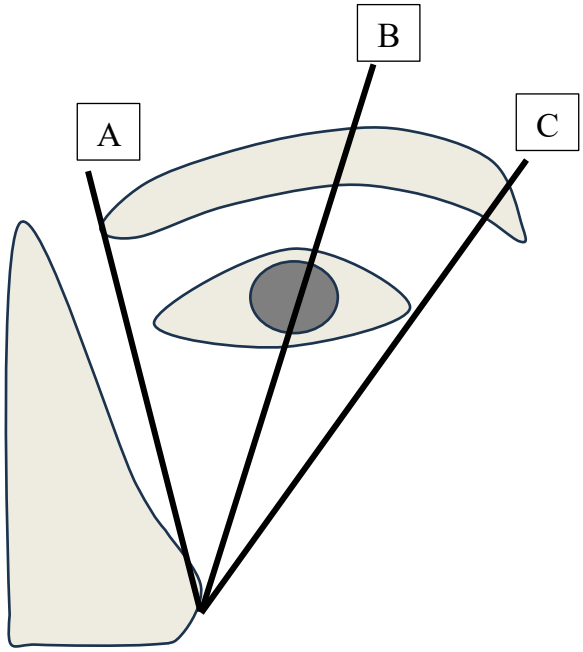


**Figure 1 -** Schematic illustration of the ideal eyebrow shape

*Source: [9]*

The apex (arch peak) is positioned on a vertical line running directly above the lateral limbus of the cornea (point C), ensuring that the ratio of the medial to lateral eyebrow length corresponds to the ideal "golden" ratio φ (phi), which is 1:1.618.

Various approaches exist for determining the ideal eyebrow shape. In the study by Yalçınkaya, E. [13], the fundamental principles for shaping eyebrows in women of European descent are systematized. Notably, R. Ellenbogen [5] largely supported the criteria proposed by M. Westmore in 1975, though he emphasized that the caudal hairs of the medial eyebrow should be positioned 1 cm above the supraorbital rim. In contrast, Gunter, J.P. (1997) believed the medial eyebrow should sit below the

supraorbital rim. He also stated that the apex should be located at the junction between the middle and lateral thirds [7].

Yalçınkaya E. and colleagues [13] offered additional recommendations for ideal eyebrow positioning:

- 15 mm between the upper eyelid fold and the lower eyebrow edge;
- 2.5 cm from the eyebrow to the center of the pupil;
- 1 cm from the eyebrow to the supraorbital rim;
- 5–6 cm from the eyebrow to the hairline;
- the average distance from the pupil center to the top of the eyebrow is 2.5 cm, and from the top of the eyebrow to the hairline is 5 cm.

Gunter J.P. also emphasized that assessing the ideal eyebrow shape is difficult without considering other features of the periorbital region. He defined several criteria for attractive eyes [4]:

- the intercanthal axis should be slightly tilted upward from the medial to the lateral corner;
- the upper eyelid should cover 1–2 mm of the iris;
- the medial segment of the upper eyelid margin should be more vertical than the lateral segment;
- the upper eyelid fold should run parallel to the lash line and divide the lid into approximately two-thirds upper and one-third lower (not exceeding a 1:1 ratio);
- the medial extent of the supratarsal fold should not go beyond the inner canthus;
- the lateral extent should not extend past the outer eye corner;
- there should be no or minimal scleral show between the lower lid and iris;
- the lower eyelid margin should gently curve from medial to lateral with the lowest point between the pupil and lateral limbus.

Gunter J.P. classified the intercanthal distance as normal (“well-spaced”), increased (“wide-set”), or decreased (“close-set”). While agreeing with M. Westmore regarding the placement of the medial eyebrow, he noted that with increased intercanthal width, the eyebrow should begin medially to the inner canthus, and with decreased width – more laterally [4].

Karacalar, A. (2005) stressed that the ideal eyebrow shape depends on the facial structure. The Westmore model is not optimal for elongated or square faces. For elongated faces, a flat brow is more appropriate, while lateral curvature can soften the angles of a square face [8].

Despite the abundance of research, clinical protocols, and standardized algorithms, eyebrow aesthetic rehabilitation remains an area where universal solutions do not exist. Every clinical case is unique due to individual facial morphotype, scar type and quality, degree of tissue atrophy or hyperplasia, and the patient's aesthetic expectations. Recognizing this clinical complexity forms the core of the author's contribution to the field: affirming the leading role of a personalized approach, even within the framework of general standards.

Studies such as those by Chen et al. [3] have proposed comprehensive standardized procedures for eyebrow reconstruction following scarring. However, as shown in the works of Baker [2], Gunter [7], and Westmore [12], universal models (e.g., an arch above the lateral limbus, medial start point aligned with the nasal ala) may not reflect the anatomical or cultural norms of every patient. The specialist, therefore, plays a multifaceted role – not only as a technician but also as an analyst, designer, and communicator capable of:

- assessing actual anatomical limitations (e.g., in cases of contractures, scarring, asymmetry – Karacalar [8]);
- selecting appropriate reference points for facial aesthetic harmonization (e.g., considering the brow's influence on emotional expression – Knoll [10]);
- personalizing the surgical strategy based on morphotype (as noted by Alex [1]).

Specifically, in post-traumatic or post-procedural deformities, even precise replication of an "ideal" eyebrow shape (e.g., using the model by Yalçınkaya et al. [13]) may fail to produce the desired result if facial type, intercanthal distance, or ethnic features are not considered. It is also essential to account for modern two-stage techniques involving fat grafting, which improve graft bed quality prior to hair implantation [4].

**Conclusions** Thus, successful aesthetic reconstruction of the eyebrows is a

synthesis of protocol and sensitivity to the individual case, where the specialist's task goes beyond restoring a lost contour – it is about achieving harmonious visual integration of the new brow into the patient's overall facial aesthetics. This perspective, grounded in an adaptive, clinically sound, and emotionally aware approach, defines a qualitatively new stage in the evolution of aesthetic rehabilitation.

This study reviewed a standardized protocol for correcting eyebrow shape in post-traumatic and post-procedural deformities. The protocol outlines a clear sequence of diagnostic and therapeutic steps – from evaluating scar tissue type and vascularization to selecting donor material, creating graft channels, and determining the individual aesthetic shape of the brow. The strength of this protocol lies in its clinical validity, evidence-based safety, and consideration of anatomical gender differences, age-related changes, and facial types.

At the same time, the key feature of the author's approach is the emphasis on individualization: no model or protocol can fully capture the unique parameters of each patient. Even precise morphometric proportions must be adapted to intercanthal width, periorbital contour, facial expressiveness, skin thickness, and the patient's personal aesthetic perception. The specialist acts as an integrator of standardized methods and clinical intuition, combining objective methodology with aesthetic sensitivity – this is what defines success in the field of aesthetic rehabilitation.

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