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Direct brow lift – indications, diagnostics, operating techniques

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HIGHLIGHTS

Direct brow lifting is the most recommended method, providing long-lasting results, mainly in patients with involutional brow ptosis and facial nerve paralysis.

ABSTRACT

Eyebrow lift is one of the most effective rejuvenating procedures in facial plastic surgery. Lifting the aging soft structures around the eye socket yields both cosmetic and, in some cases, therapeutic effects. Regardless of the indications, preoperative assessment of the patient should be based on a thorough interview, establishing the patient's expectations, determining the achievable outcome of the procedure, and anticipating potential complications. During the physical examination, it is crucial to identify relevant anatomical structures, assess facial symmetry, scope, and the technique of the procedure. Often, patients opt for combining direct eyebrow lift with eyelid surgery, significantly enhancing the overall result. The primary complication of direct eyebrow lifting is a visible scar, which may be a contraindication for individuals prone to keloid formation and those with a brow deficit. The aim of this study is to define the indications, diagnostics, and describe the surgical techniques used in eyebrow lift procedures.

Key words: direct brow lift, facial plastic surgery, brow ptosis, eyebrow asymmetry, facial nerve palsy

AIM AND METHOD

Review of current medical literature using PubMed and NCBI databases. The aim of the review is to provide doctors with information regarding the analysis of causes of eyebrow ptosis, diagnostic and surgical techniques, as well as medical indications and patient expectations when opting for eyebrow lift.

INTRODUCTION

With age, the position of the eyebrows relative to the supraorbital rim may change, causing them to droop. The accumulation of lax skin in this area not only ages the upper part of the face but can also lead to a restriction of the visual field. Other, less common, causes of this phenomenon include acquired facial nerve paralysis or trauma to the orbital region [1]. Over the years, numerous techniques have been developed for eyebrow lifting. The use of botulinum toxin type A (BTA) and hyaluronic acid belongs to conservative techniques, without the use of a scalpel, but also without the possibility of achieving a permanent effect. Surgical techniques include open and endoscopic methods, which will be discussed later in this paper [2]. Gathering a detailed medical history, conducting a physical examination, and understanding various surgical techniques are the key elements in selecting the optimal method based on the patient's needs [3].

ANATOMY AND FUNCTIONS

A doctor undertaking surgical techniques for eyebrow lift must be familiar with the anatomy of the upper one-third of the face and the periorbital region, as well as its function, regardless of the chosen method. The eyelids and eyebrows are part of the protective apparatus of the eye, and through the cooperation of muscles, tendons, and other soft tissues, they serve communicative and emotional functions [4]. The frontalis and corrugator muscles are the main facial mimetic muscles. They are responsible for furrowing the forehead and lifting the eyebrows, enabling the expression of emotions such as fear, anger, surprise, sadness, or dissatisfaction (fig. 1A–F).

The circular muscle of the eye enables blinking, closing the eyelids, and squinting. Impairment of its function manifests as insufficient closure of the eyelid slit, leading to exposure of the cornea, its drying, the formation of epithelial defects, and in the final stage, ulceration and a general deterioration of vision [5].

The mobility and innervation of these muscles are controlled by the facial nerve, specifically its anterior branch, running through the temporal area, laterally from the central forehead line. The supraorbital and supratrochlear nerves are branches of the first division of the trigeminal

FIGURE 1

A – neutral expression. B – fear. C – anger. D – surprise. E – sadness. F – dissatisfaction.

nerve and are responsible for transmitting sensation from the upper part of the face – eyebrows, forehead – to the hairy skin on the front of the head [6].
Impairment of the function of these muscles leads to facial distortion and asymmetry, making it a common reason for seeking specialist care [5].
In the aging process, there is an overgrowth of the corrugator muscle, leading to the formation of a vertical furrow between the eyebrows (known as 'frown lines' or 'lion's wrinkles'). The loss of elasticity in the frontalis muscle and its thinning contribute to the appearance of horizontal wrinkles on the forehead. The entire process begins with simple expression lines, which, as they deepen, form grooves or folds reaching the reticular layer of the skin. The loss of lateral support of the outer brow, combined with the loss of fullness in the upper eyelid, gives the impression of brow descent [7]. According to Park, focusing on correcting the lateral aspect of the brow yields the greatest rejuvenating effect on the face [8].
In summary, aging of the tissues in this area most commonly manifests as wrinkles (rhytids), drooping eyebrows, herniation of lower eyelid fat, dermatochalasis, as well as loss of volume or deflation (atrophy of bone and fat). This constitutes a significant reason for refining methods that reverse this process [9].

DIAGNOSTICS

When examining a patient, it is important to determine the type of skin, the position of the eyebrows, and the characteristics of wrinkle formation. It is worthwhile to inquire whether eyebrow descent is bothersome for the patient and if it causes difficulties, such as wearing glasses. During the conversation, attention should be paid to the patient's habit of raising the head and furrowing the brows, as a compensatory mechanism for limited field of vision. Past eyelid plastic surgeries, the presence of dry eye syndrome, or androgenetic alopecia in the medical history are crucial pieces of information for the surgeon and should not be overlooked. Congenital facial asymmetries should not be altered unless it aligns with the patient's expectations [10].
The ideal position of eyebrows in women is described as reaching above the bony edge of the supraorbital rim, with an upward arch. In men, it should occupy the upper edge of the eye socket and have a flatter trajectory [11]. A reproducible measurement is the distance between the center of the pupil and the peak of the eyebrow – it should be 25 mm [12]. A smaller distance may suggest eyebrow descent, and their correct position largely depends on age, gender, profession, and geographical location. The "ideal" eyebrow position should be considered individually with each patient. Additionally, measurements of eyelid aperture height during downward gaze should be taken (average norm is 9 mm). It is advisable to add photographic documentation of the patient's eye area to avoid postoperative suggestions of iatrogenic asymmetry [13].
In conclusion, when establishing a diagnosis, the surgeon must differentiate the mechanism through which eyebrow descent occurred and based on that, individually select the appropriate method. They should discuss the potential effect and ensure that it aligns with the patient's preferences [10].

INDICATIONS

The main indications for any type of eyebrow lift include:
- limited field of vision
- pseudoblepharoptosis (the eyelid appears drooped, but there is no pathology of the eyelid muscles or levator aponeurosis)
- eyebrow descent
- facial nerve paralysis
- brow asymmetry
- deep forehead wrinkles
- glabellar lines
- aesthetic considerations related to a sad, chronically tired facial expression [10].

Clinical situations in which direct eyebrow lift is preferred include:
- absence of wrinkles on the forehead
- unilateral facial paralysis
- prominent craniofacial skeleton on the forehead (limits endoscopic access)
- receding hairline (e.g., in cases of androgenetic alopecia)
- baldness
- severe, drooping eyebrows
- previous scar on the eyebrows [14].

In summary, direct eyebrow lift is performed more often for facial reconstruction purposes than for cosmetic reasons [15].

CONTRAINDICATIONS TO EYEBROW LIFTING SURGERY

1. Body dysmorphic disorder.
2. Previous eyelid surgery (relative contraindication).
3. Dry eye syndrome or reduced tear production.
4. Lack of acceptance of the risk of visible scarring.
5. Thin eyebrows.
6. Tendency to develop hypertrophic scars (keloids) [16].

OPERATING TECHNIQUES

To lift the eyebrows, non-surgical methods can be employed, such as injections of BTA and hyaluronic acid. These methods are reversible and do not require extensive

operator experience. However, their effect is temporary, leading to the need to find a permanent way to lift the eyebrows, namely through surgical lifting methods:

- direct brow lift with an incision along the upper edge of the eyebrow
- midforehead brow lift with an incision in the middle of the forehead
- coronal incision brow lift for lifting the eyebrows with a coronal incision
- endoscopic brow lift using an endoscope for the procedure.

The mentioned methods result in a relatively stable effect, largely dependent on the surgeon's competence and the equipment used. Potential complications can be more problematic and may necessitate the patient to undergo re-operation. If there are indications, the effect of the eyebrow lift procedure can be enhanced by combining it with eyelid surgery [1].

Table 1 presents the main advantages and disadvantages of the known methods of eyebrow lifting, depending on the patient's needs [2].

Direct brow lift

The first description of direct eyebrow lift for the purpose of elevation appeared in the publication of the French surgeon Passot in 1919 [17].

This technique involves an incision along the upper line of the eyebrow to camouflage the postoperative scar at the level of the eyebrow hair follicles. The individual stages are outlined below, along with photographs of a patient diagnosed with drooping eyebrows who qualified for the procedure (fig. 2A).

Before commencing the eyebrow lift surgery, the planned incision line should be marked with a marker. Marking is performed on a patient in a standing position, starting from the lower boundary, which is the upper line of the eyebrow. It is important to note that the eyebrow position after the operation will be maintained approximately halfway be-

TABLE 1

The main advantages and disadvantages of known methods of brow lifting.

	Definition	Indications	Contraindications	Advantages	Defects
Botulinum toxin type A (BTA)	To treat the depressor muscles of the brow using BTA	The desire to lift the lateral brow using a less invasive method	Hypersensitivity to BTA	Minimally invasive, cost-effective, and without significant, lasting side effects	Temporary lifting effect on the central and lateral brow, minimal impact on the elevation of the medial brows
Hyaluronic acid	Injection of filler into the lateral part of the brow to support periorbital fat tissue	Improvement of the elevation of the tail of the brow in cases where BTA provides insufficient lifting of the brow	Patients with one eye	Fillers can improve the contour and volume of the brows	Little impact on the central brows, the possibility of serious side effects
Direct brow lift	Elliptical incision directly above the brows	Facial nerve palsy, men with receding hairlines, patients who cannot undergo general anesthesia	If a specific elevation of the medial arch of the eye is particularly desired	The greatest elevation per millimeter of excised tissue	The risk of scarring
Coronal incision brow lift	The coronal incision extends between the temporal depressions, behind the hairline, followed by extensive tissue excision, preparation, and elevation	Very heavy forehead with significant excess tissue and wrinkles	High hairline	Extensive incision with potential for persistent hair loss and numbness	High effectiveness, no need to use advanced equipment
Endoscopic brow lift	Three to five small incisions on the hairy skin of the head and introduction of an endoscope	The procedure of choice for patients with eyebrow asymmetry	High hairline	Small incision with minimal risk of permanent hair loss and numbness	Longer learning curve, requires an endoscope
Midforehead brow lift	Upper incision marked along the midforehead fold, followed by the excision of an appropriate amount of tissue	Older men with significant brow ptosis, with a limited field of vision	Wrinkle-free forehead	No need for general anesthesia, lowering the frontal hairline	Clear, reddened scar, less effective method in the case of lateral brow ptosis

tween the upper and lower incisions; we mark the upper incision, creating the shape of an ellipse or crescent [14] (fig. 2B).

FIGURE 2A

The patient before surgery.

FIGURE 2B

The patient during the surgery with a marked area of tissues to be excised.

After local anesthesia (1% lidocaine with 1 : 100,000 epinephrine, with a maximum of 7 mg lidocaine per kg of body weight) [1], we make a lower incision parallel to the axis of the hair follicles, holding the scalpel at a right angle to the skin [18–21]. Nowadays, many surgeons modify the incision by changing the angle of the scalpel to 45°. This allows for bringing the incision line closer to the line of the eyebrow hair follicles with less risk of damage. The upper incision is also made at a 45-degree angle, ensuring the preservation of sensory and motor nerves running from the medial side. Such an incision minimizes the risk of a visible scar [22, 23]. The circular muscle is never incised [15]. In patients who have previously experienced facial nerve paralysis, however, the frontal muscle can be incised to allow for deeper placement of stitches. The incision should be made laterally from the supraorbital nerve.

The deep layer of the wound is closed with absorbable sutures (such as Vicryl or Monocryl) through the true skin – as close to the surface of the epidermis as possible – and the subcutaneous fat. The skin wound is closed with a 4/0 or 5/0 monofilament mattress suture (e.g., Prolene – Ethicon, United Kingdom). Layered sutures like these allow for the most satisfactory scar formation (fig. 2 C, D). For additional support to the eyebrows, in the case of facial nerve paralysis, the lateral part of the eyebrow can be sutured to the periosteum, with deep-seated knots [24].

FIGURE 2C

The patient just after surgery.

FIGURE 2D

The patient one month after surgery.

The procedure is often performed in conjunction with eyelid surgery. Following the surgery, we apply a dressing according to the surgeon's preferences. The stitches are removed approximately 10 days after the operation [1].

Complications

Although rarely, complications may include:

- wound infections
- hematomas
- asymmetry of the eyebrows
- forehead paresthesia
- injury to the temporal branch of the facial nerve
- hypertrophic scars
- eyebrow hair loss
- the need for revision
- excessive correction
- dry eyes.

The majority of potential complications are of a transient nature [3].

DISCUSSING

According to Booth et al., direct eyebrow lift is the method of choice in treating drooping eyebrows due to involutional changes or facial nerve paralysis [21]. In younger patients, there is concern about a potentially visible scar. According to Green et al., careful, layered suturing of the wound can eliminate this problem [25]. In a satisfaction study conducted by Booth et al. from 1989 to 2002, 74% of patients (32/43 eyebrows) assessed the satisfaction level with the achieved eyebrow lift as high, and 81% of patients (35/43 eyebrows) rated the appearance of the scar as satisfactory or more than satisfactory. It is important to note that all respondents constituted a group of patients qualified for the procedure for therapeutic rather than cosmetic reasons [21].

The direct eyebrow lift procedure stands out with the highest degree of elevation per millimeter of excised tissue, making it particularly useful for patients with facial nerve paralysis, where maximum elevation is indicated. Karimi et al. believe that this procedure provides the surgeon with better control over the position and contour of the eyebrows compared to other methods [2].

Authors of scientific papers in this field debate on the optimal angle for the scalpel incision. The most commonly described incision is made at a 90-degree angle [18, 19, 21]. A 45-degree angle minimizes the risk of scarring [22, 23], and according to Feinendegen et al., the optimal angle is 20° [26].

The most common complication is paresthesia or numbness in the forehead. According to Booth et al., as many as 74% of the subjects (32/43 eyebrows) experienced changes in sensation on the forehead, but it was bothersome for only 7% of the participants (3/43 eyebrows) [21]. Green et al. emphasize the importance of making the incision more superficially from the medial side to avoid damage to the supraorbital nerve and blood vessels, thereby minimizing forehead paresthesia [25].

In individuals with deep forehead wrinkles and a receding hairline, Rafaty et al. recommend the technique of brow lift with an incision in the middle of the forehead. Potential complications are the same as in the case of direct brow lift, but according to Rafaty et al., the postoperative scar is less visible [27].

During the coronal brow lift procedure, the incision line should run several centimeters above the hairline, allowing for the correction of forehead wrinkles. However, this procedure is not a good choice for patients with a high hairline and thinning hair. The method's effectiveness is considered high. Extensive incision, although not visible, is associated with many complications such as dysfunction of sensory and motor nerves, skin necrosis, permanent overcorrection, hair loss, and asymmetry of the eyebrows and eyelids [21]. In a study by Fett et al., all patients who underwent the surgery (22 individuals) experienced itching around the head and tension in the upper part of the face, but the symptoms persisted only for a few weeks. Cosmetic outcomes were satisfactory in all 22 cases [28].

The latest method of brow lift is endoscopic brow lift, involving the creation of several small incisions (3 to 5) along the frontal and temporal hairline to facilitate the introduction of the endoscope and surgical tools. It is characterized by invisible scars, wrinkle smoothing, and a low risk of permanent hair loss. The drawback is a steep learning curve and the requirement for an endoscope [21]. According to Cho et al., endoscopic brow lift has a lower complication profile compared to traditional open methods; however, open methods still provide a more effective and long-lasting lifting effect. Results should be interpreted cautiously due to the low percentage of conducted studies [29].

Regardless of the method, a successful outcome of the procedure is associated with a thorough preoperative assessment, knowledge of anatomy, symmetrical marking of the incision line, and the surgeon's excellent soft tissue operating technique [3].

CONCLUSIONS

Each of the operational brow lifting techniques is characterized by good effectiveness, but the choice of technique should be tailored to the specific case. Potential complications are mostly temporary, and satisfaction with the procedure is high.

Direct brow lifting is the most recommended method, providing long-lasting results, mainly in patients with involutional brow ptosis and facial nerve paralysis. It is a method with the highest degree of brow elevation per millimeter of excised tissue, allowing for the most precise brow repositioning. Proper wound closure and careful tissue preparation in the medial portion of the brow help reduce the risk of visible scarring and minimize forehead paresthesia.

Figures: The images of the surgical procedure are sourced from the archive of Radosław Różycki, MD, PhD.

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Radosław Różycki – idea, work coordination, substantive assistance; Małgorzata Różycka – literature analysis, description of direct eyebrow lifting, surgical techniques and method selection, summary; Piotr Nesterowicz – description of crown eyebrow lifting, assistance in preparing the manuscript, photo material; Katarzyna Różycka – description of endoscopic eyebrow lifting, assistance in preparing the manuscript; Krystian Bakalarski – description of the non-invasive eyebrow lifting method, assistance in preparing the manuscript; Alan Chamernik – description of a facelift with an incision in the middle line of the forehead, assistance in preparing the manuscript; Katarzyna Ulaszewska – description of the diagnosis of eyebrow ptosis, assistance in preparing the manuscript.

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