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The use of algorithms in aesthetic facial surgery

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ABSTRACT

Objective. To analyze scientific publications reporting on the development and implementation of algorithms in clinical practice and their effectiveness.

Material and methods. The literature search was performed using the databases Scopus, Medline (PubMed), eLibrary (in total: 32 scientific papers).

Results. Data on the principles of algorithm development were obtained, and the assumption of a trend towards the introduction of algorithms in various fields of plastic surgery was confirmed.

Conclusions. Based on the data of scientific research, it can be concluded about the relevance of the development and implementation of algorithms in the work of an aesthetic surgeon in surgical practice. All authors unequivocally point to the effectiveness of the introduction of algorithms into clinical practice, some of which were developed by them for the first time. When planning and conducting surgical interventions, the need for basing on individual patient data is emphasized, as well as the relevance of developments of this type to improve the achievement of better results of surgical correction. In some cases, the introduction of algorithms into clinical practice has made it possible to achieve a significant improvement in the quality of life of patients after the interventions performed. Each of the correction methods has its own effectiveness. Based on the positive results of the work on the development and implementation of algorithms in clinical practice, the development of this type for aesthetic interventions on the lower third of the face would allow: 1) improve the aesthetic result, 2) improve the quality of the intervention, 3) reduce the number of interventions necessary to achieve a positive and long-term effect, 4) reduce the likelihood of short-term and long-term postoperative complications, 5) reduce the cost of treatment and shorten its duration.

Keywords: *plastic surgery, algorithms, aesthetic surgery, facial rejuvenating surgery.*

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Plastic surgery is actively developed in the last decades. New medical technologies are essential in this process. However, there are significant differences related to local surgical rules and individual experience of surgeons. Various original surgical methods based on classical and modern technologies are offered. At the same time, requirements for the quality of medical care become higher. In this regard, there are questions on effective and safe surgical algorithms supported by objective data. Some authors believe that introduction of work algorithms may be useful for improving the quality of surgical intervention, aesthetic results and patient satisfaction.

Face is of particular interest for plastic surgeons due to obvious signs of aging in this area.

Analyzing long-term postoperative follow-up, self-assessment data, quality of life, histological and instrumental data on skin in people of different ages, Manturova N.E. assessed duration of effect after various surgical corrections of skin involution. The author developed the algorithm for the management of patients with face aging considering various data [1] **(Fig. 1)**. A multidisciplinary approach combining conservative methods for correction of skin involution and surgical procedures for aesthetic defects following aging was proposed. The authors developed the optimal individualized algorithms for surgical correction of various signs of skin aging. All algorithms are based on preoperative analysis of clinical, laboratory and morphological parameters of skin [1–5].

Algorithms in aesthetic surgery of the upper third of the face

Aesthetic correction is traditionally performed for ptosis of the eyebrows. Patients with signs of aging in the upper third of the face most often do not pay attention to individual symptoms, but present a complex of complaints including transverse and longitudinal wrinkles, ptosis of the head, body of the eyebrow, or their combination. There are various surgical interventions for these complaints (direct brow lift, median brow lift, pretrichial brow lift, temporal brow lift, coronal brow lift, endoscopic brow lift, transblepharoplasty) [6, 7]. In the 20th century, numerous authors made a great contribution to surgical rejuvenation of the forehead and eyebrows [8–14]. To date, open and closed surgical interventions, as well as non-surgical methods are proposed. In all cases, the authors recommend individual approach based on the patient's complaints. Over

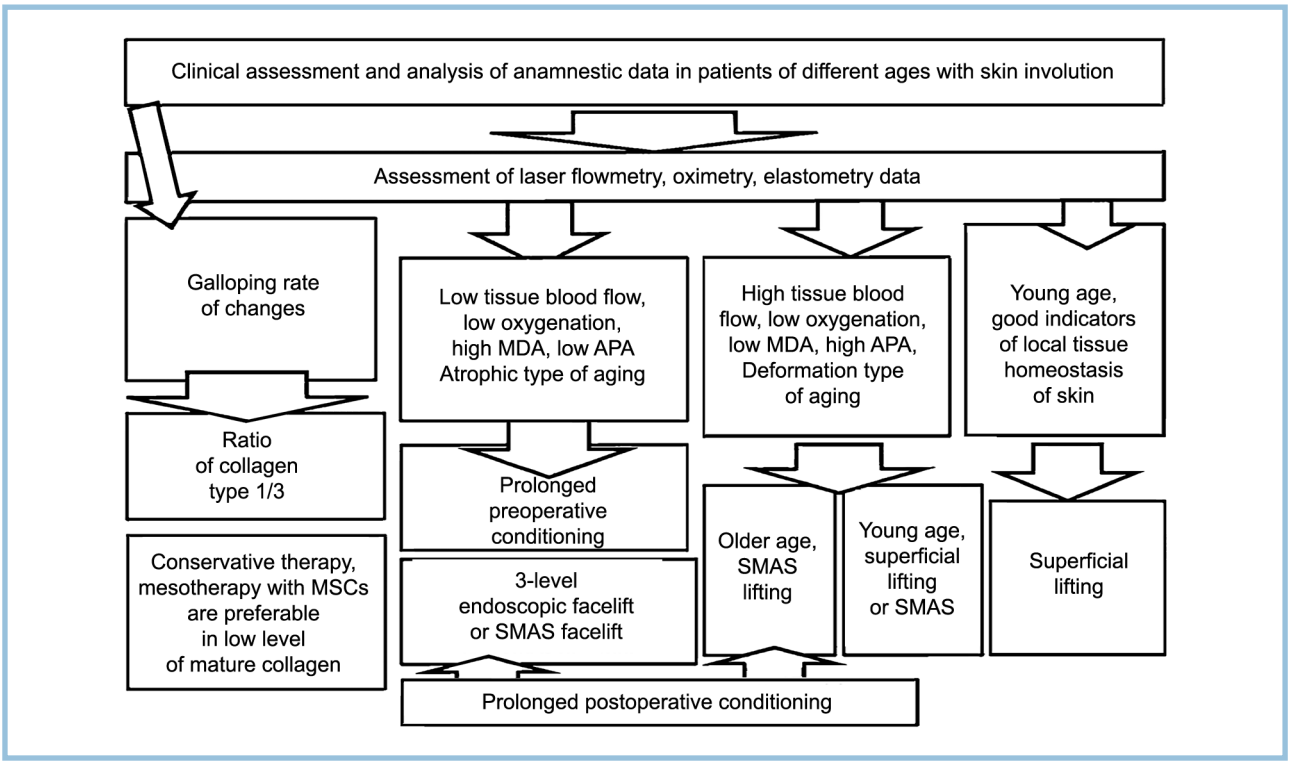

Fig. 1. **Manturova *N.E.* (2012). Algorithm for patients with facial skin involution [1].**

time, some surgical techniques have changed due to development of technologies [15–19].

Nahai F. et al. [20] describe own experience of surgical interventions on the upper third of the face. They developed a clear plan regarding criteria for upper and lower eyelid aesthetic surgery. This plan includes assessment of baseline data and basic needs of patients. Aesthetic data include assessment of skin, its excess, type of aging, muscle activity and morphology, fat pads. Safety data include upper eyelid ptosis, muscle tone, eye depth and canthal position of the eye. An algorithm for choosing intervention depending on these data is proposed **(Fig. 2)**.

L. Piovano and M. D'Ettorre (2017) performed a meta-analysis of data on forehead and eyebrow rejuvenation [21]. Moreover, they analyzed 123 cases of forehead and eyebrow lift. The authors developed the algorithm considering these data and emphasized its usefulness for young aesthetic surgeons **(Fig. 3)**.

R.J. Rohrich and M.-J. Cho retrospectively analyzed 159 patients who underwent brow rejuvenation surgery between 2008 and 2018. Demographic and surgical data, complications and outcomes were assessed. The authors presented appropriate algorithm [22] **(Fig. 4)**.

J.E. Zins and A. Meyers (2022) presented own experience of surgical correction of the upper third of the face [23]. The authors described the nuances of open forehead and brow lift, endoscopic forehead and brow lift, endoscopic temporal brow lift, direct brow lift and sliding brow lift. Considering clinical experience and patient satisfaction, they compiled the algorithm based on the difference in soft tissue characteristics. Later this algorithm was tested in practice with positive results. The authors confirmed favorable aesthetic results and QoL improvement. It was concluded that surgical approach to the upper third of the face has undergone significant changes over the past 20 years due to popularity of these procedures. To date, it is characterized by increased demands of patients on the results of surgical intervention. The authors emphasized the role of individual approach depending on unique characteristics of soft tissues **(Fig. 5)**.

Algorithms in aesthetic surgery of the middle third of the face

Pascali M. et al. (2015) retrospectively analyzed 350 patients who underwent surgery on the middle third of the face [24, 25]. The authors described own surgical experience in this aesthetic zone. Criteria for preoperative assessment of patients based on objective data were developed. However, the authors did not propose a full-fledged algorithm. Midface lift with temporal attachment was performed if zygomatic zone replenishment was necessary. Midface lift with transosseous periorbital fixation was used for effective correction of nasolacrimal sulcus.

A.A. Jacono and J.J. Rousso (2015) proposed a classification system for midface aging **(Table)** [26]. The authors emphasized that aging is a result of many factors justifying complex approach to midface rejuvenation. This is especially true for patients with more pronounced signs of

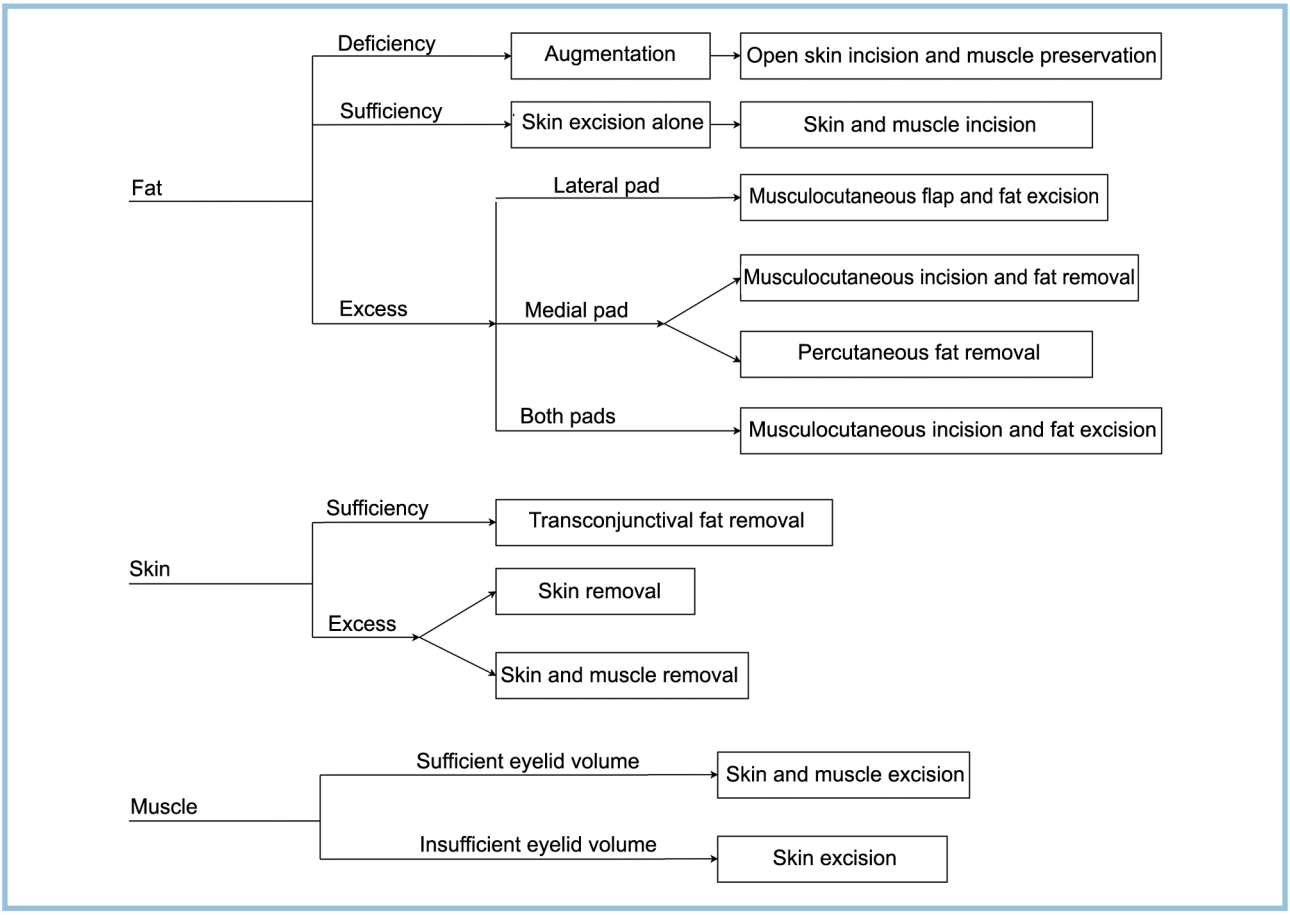

Fig. 2. **Nahai *F.* (2011). Upper eyelid blepharoplasty options [20].**

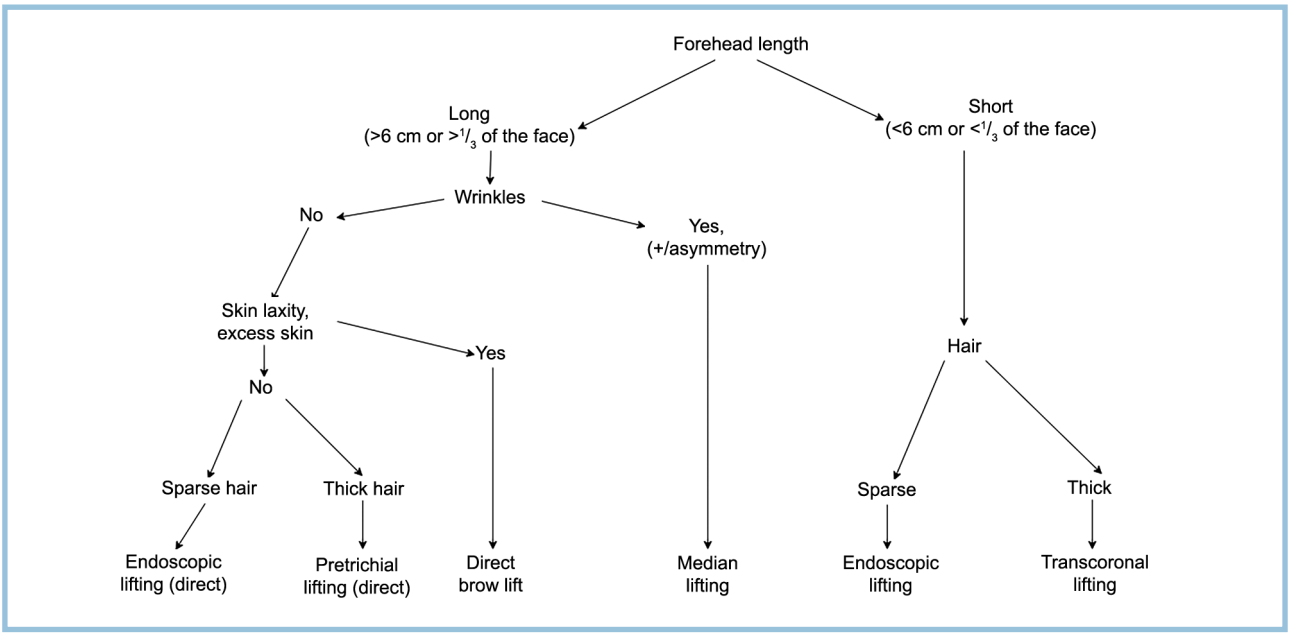

Fig. 3. **Piovano *L.* and D'Ettorre *M.* (2017). Algorithm for surgical correction of eyebrow ptosis [21].**

aging and low tissue elasticity, as well as those with hypoplastic structure of midface bones. The algorithm based on this classification was proposed **(Fig. 6)**.

Lee D.D. et al. [27] described own experience in midface surgery. They confirmed that face is a zone of increased interest and risk. Surgeons must be extremely

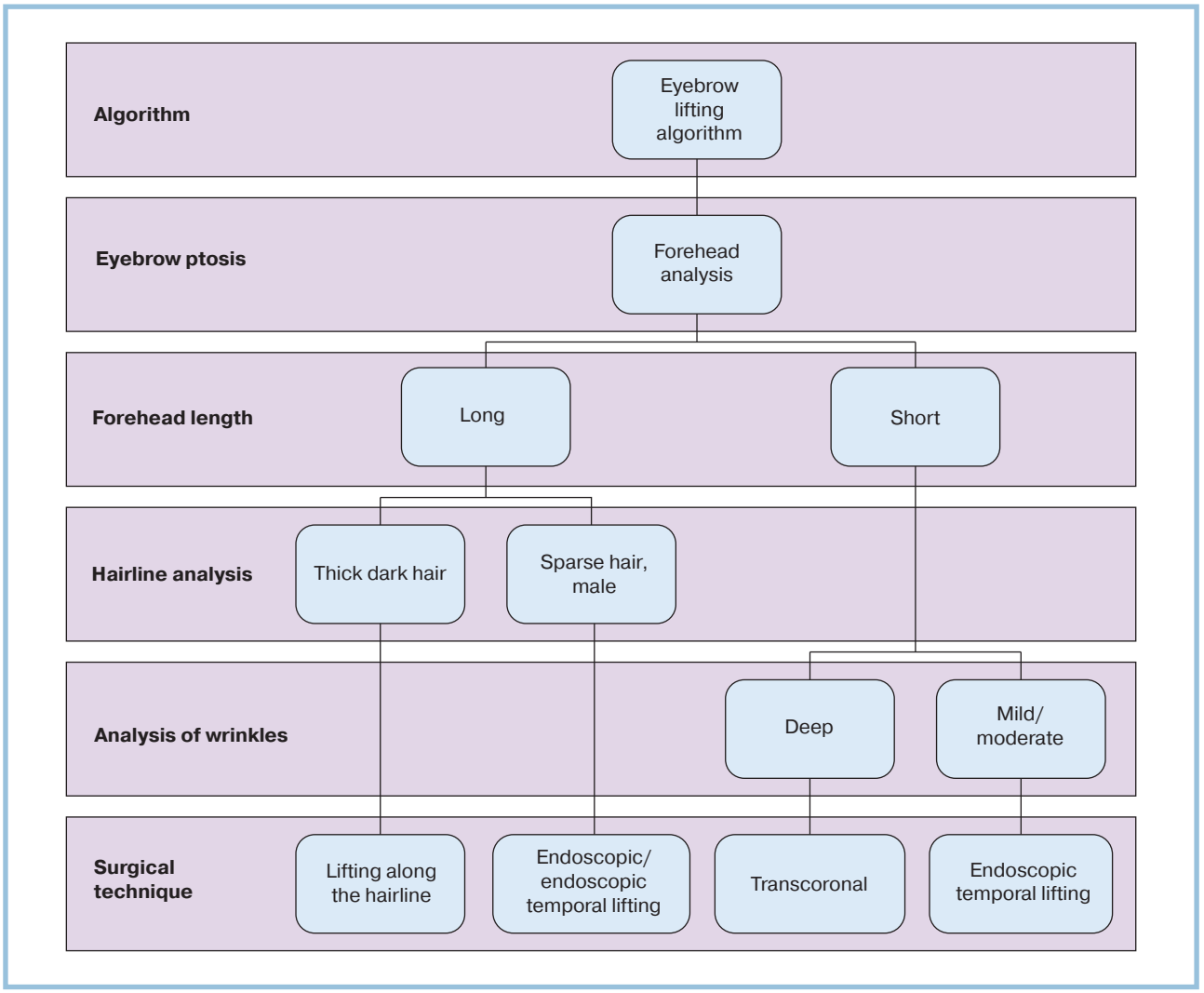

Fig. 4. **Rohrich *R.J.* and Cho *M.-J.* (2019). Eyebrow lifting algorithm [22].**

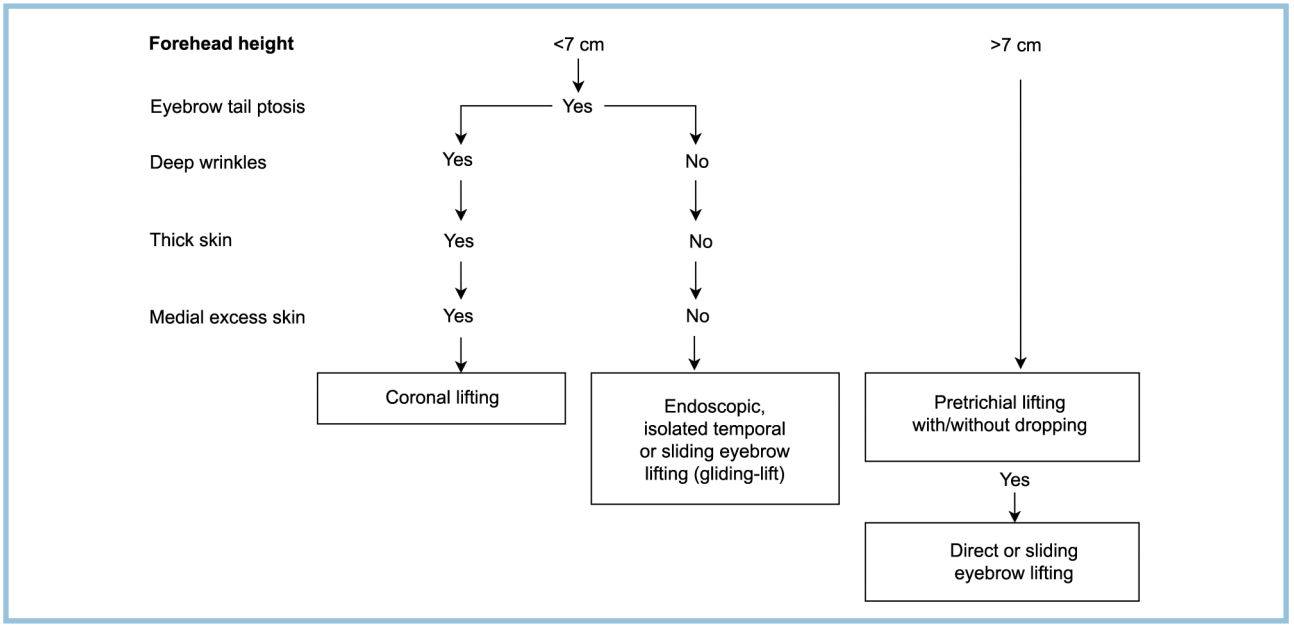

Fig. 5. **Zins *J.E.* and Meyers *A.* (2022). Algorithm for correction of eyebrow ptosis [23].**

Classification system for midface aging by A.A. Jacono and J.J. Rousso (2015) [26]

Type	Infraorbital or zygomatic volume loss	Ptosis	Loss of elasticity	Negative vector or hypoplasticity	Age
IA	+	–	–	–	<40
IB	+	–	–	+	<40
IIA	+	+	+	–	40—55
IIB	+	+	+	+	40—55
IIIA	++	++	++	–	>55
IIIB	++	++	++	+	>55

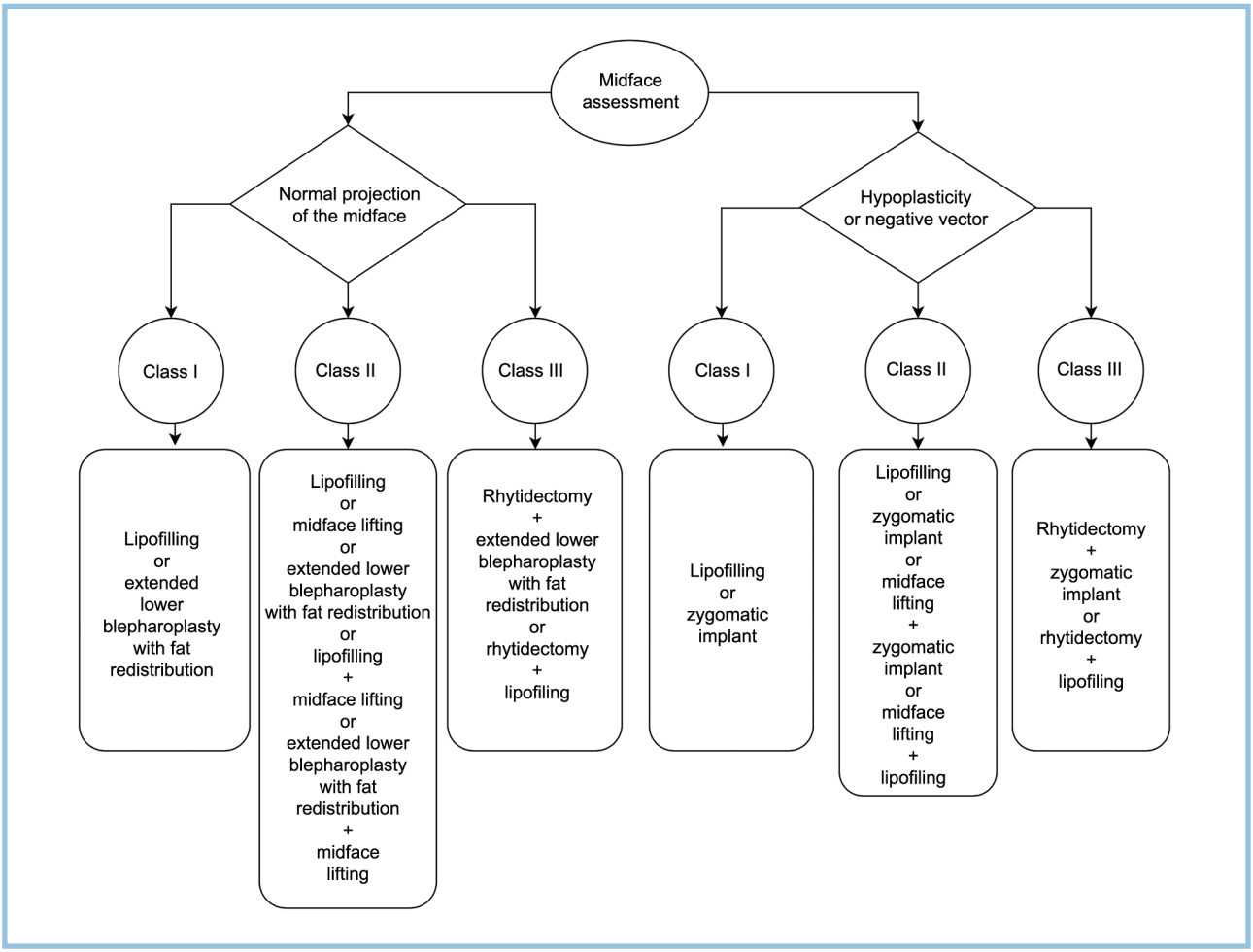

Fig. 6. **Jacono *A.A.* and Rousso *J.J.* (2015). Algorithm for midface rejuvenation surgery [26].**

careful when working in this area. The main direction of work in this zone is correction of soft tissue and bone involution. Considering more than 20-year work, they established the practical algorithm. The last one is based on the need for individualized approach, comprehensive analysis of anamnestic data and trusting relationship with a patient. Surgeon can plan the intervention in such a way as to recreate correct relationship between facial subunits using the algorithm based on the patient data. Thus, certain surgical corrections of the midface or their combinations are proposed (subperiosteal lifting, lipofilling, rhytidectomy, SMAS-lifting). In all cases, the authors emphasize individual approach to aesthetic problems thanks to the algorithm. Moreover, necessary interventions in step-by-step fashion may be performed years after treatment due to multi-stage nature of the algorithm **(Fig. 7)**.

Algorithms in aesthetic surgery of the lower third of the face

C. Botti and G. Botti (2015) described own experience of extended SMAS facelift [28]. They have standardized surgical technique and approach for more than 15 years. This approach includes several basic steps that are common to all cases, as well as subjective variations

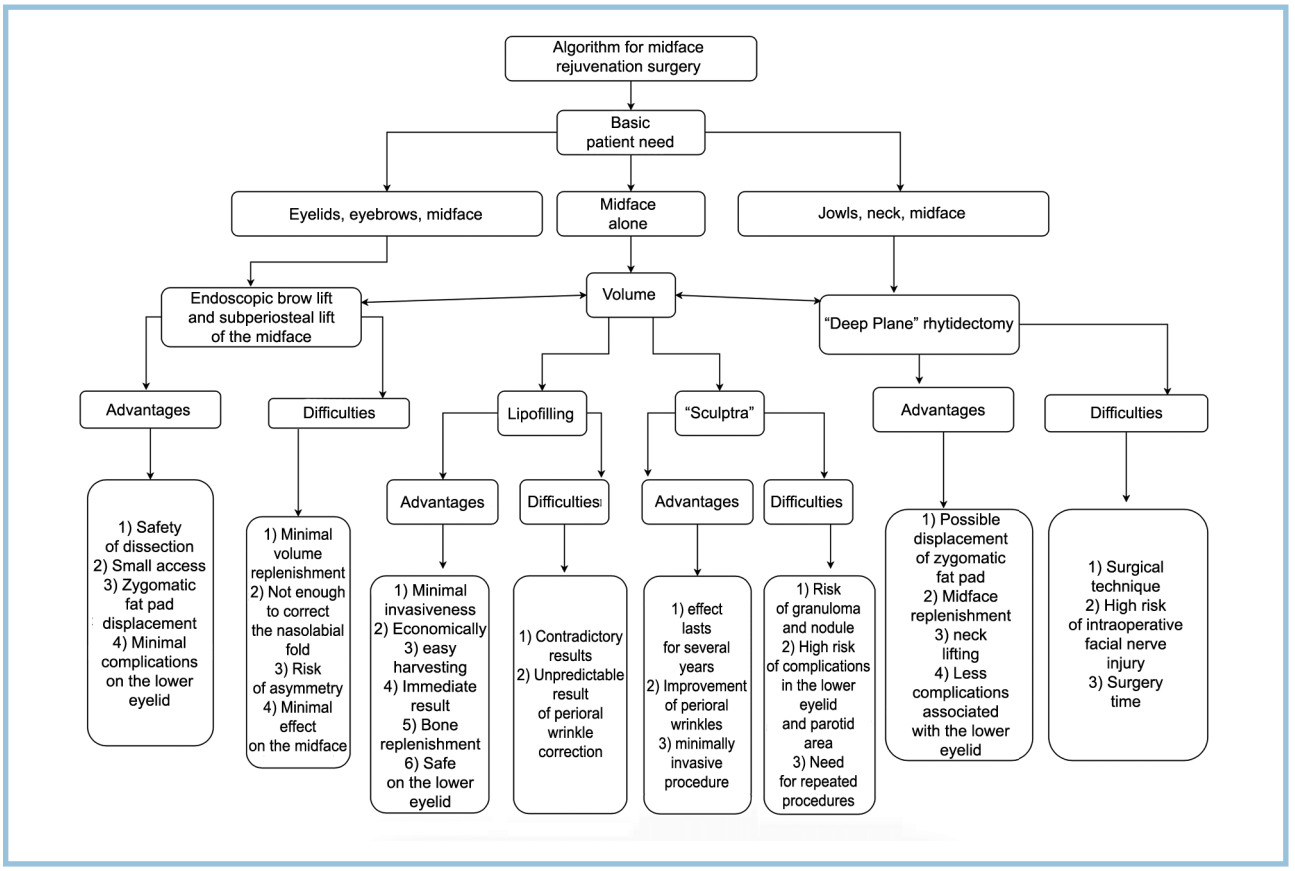

Fig. 7. **Lee *D.D.* et al. (2021). Algorithm for midface rejuvenation surgery [27].**

related to each specific deformity, gender and age of the patient. The purpose of preoperative examination is to provide the patient with correct and accurate information about surgical methods and possible complications, as well as to decide on the options for action. The surgeon decides with the patient whether surgery should be limited to the lower cheeks and neck or whether it should be extended to the midface and temporofrontal region. They should also analyze advisability of concomitant dermabrasion to eliminate wrinkles and skin defects, blepharoplasty (with or without canthopexy) for eyelid problems, regional lifting (upper lip or eyebrows) or other procedures that can provide more harmonious and full result of rejuvenation. Among the latter, the most important ones are those methods aimed at restoring lost volumes due to bone-fatty atrophy. Facelift was combined with lipofilling in 80% of patients. Facial implants were used in 10% of cases (mainly for mental and zygomatic areas). Liposuction for excessive adipose tissue is common.

Conclusion

There are various trials devoted to development and implementation of algorithms in various subsections of facial aesthetic surgery. All authors unequivocally emphasize the effectiveness of these algorithms in clinical practice. Individual data of the patient are essential for surgical interventions. Moreover, development and implementation of algorithms for aesthetic surgeons are effective to improve the results of correction. In some cases, surgical algorithms significantly improved the quality of life after interventions. Various studies emphasize necessary exactingness for correction of all areas, but face is of particular interest for surgeons and patients.

Literature data confirm clinical benefit of the above-mentioned innovations when working with the upper and middle thirds of the face. However, there are no data on algorithms for working with the lower third of the face. We can distinguish 2 main types of corrective interventions on the lower third of the face aimed at soft tissues and bones (acquired defects). There are several options for each type of corrective interventions [29–31]. For example, the most common SMAS lifting has options for Deep Plane, High SMAS, Low SMAS, etc. These variants differ in three main principles (quality of dissection, direction and force of tension of the flaps, methods of fixation).

Each method of correction has own effectiveness. Considering positive results of algorithms in clinical practice, we can argue that development of algorithms for aesthetic interventions on the lower third of the face would improve aesthetic results and quality of interventions, reduce the number of interventions needed to achieve pos-

itive long-term effects, the likelihood of short-term and long-term postoperative complication, cost and time of treatment.

Some experts express concern that incorrect algorithms can limit surgeons in choosing appropriate interventions and worsen clinical effectiveness of treatment [32]. Special attention should be paid to this aspect.

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