

**WAYS TO IMPROVE COMPREHENSIVE TREATMENT OF POST-BURN EVERSION SCARS OF THE LOWER LIP.**

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**Abstract:** Post-burn eversion scars of the lower lip represent one of the most challenging problems in reconstructive plastic surgery due to significant disruption of anatomical and functional structures and a high tendency of tissues to develop recurrent scarring. This article is devoted to the analysis of current approaches to the treatment of lower lip scar deformities after burns and to the substantiation of ways to improve the effectiveness of comprehensive therapy. An analytical review of the literature was conducted, the limitations of existing correction methods were identified, and key principles for optimizing the therapeutic and rehabilitative process were determined. A conceptual model of comprehensive treatment is proposed, including stages of preoperative preparation, surgical correction, and postoperative rehabilitation with the use of modern minimally invasive and physiotherapeutic technologies. The results may serve as a basis for improving clinical recommendations and enhancing functional and aesthetic outcomes in patients with this pathology.

**Keywords:** post-burn scars; lower lip eversion; scar deformity; plastic surgery; reconstructive treatment; comprehensive therapy; rehabilitation; scar prevention

**Introduction.** Post-burn scar deformities of the face are among the most complex and challenging consequences of thermal injuries. Eversion scars of the lower lip have particular functional and aesthetic significance, as they affect not only the patient's appearance but also chewing, articulation, and facial expressions, which significantly reduce quality of life and social adaptation. According to various authors, injuries to the lips and perioral area occur in 12–18% of burn cases, with 60–70% resulting in persistent scar changes that require comprehensive medical intervention [1–3].

The anatomical structure of the lower lip, its high mobility, and functional load contribute to the development of severe scar contractures and eversion, leading to excessive salivation, speech difficulties, impaired mouth closure, and chronic inflammation of the mucous membrane. Despite the availability of various reconstructive surgical techniques, there is no universally accepted approach for treating post-burn eversion of the lower lip. Outcomes of correction are often unsatisfactory due to recurrent scarring, tissue deformation, and insufficient effectiveness of rehabilitation measures [4, 5].

In recent years, interest has increased in developing comprehensive treatment programs that combine surgical and conservative methods aimed at restoring lip function, preventing recurrent scarring, and improving aesthetic outcomes. However, a review of the literature indicates insufficient scientific substantiation of existing approaches and the lack of standardized protocols for managing patients with this pathology [6, 7].

**Objective of the Study.** To substantiate and propose ways to improve the effectiveness of comprehensive treatment of post-burn eversion scars of the lower lip based on an analysis of modern methods and optimization of the stages of therapeutic and rehabilitative care.

Etiology and Pathogenesis of Post-Burn Scar Deformities of the Lower Lip. Post-burn scar changes develop as a result of deep thermal injury to the skin and underlying tissues,



accompanied by cell death, impaired microcirculation, and an inflammatory response. The scarring process includes three main stages: inflammation, proliferation, and remodeling of connective tissue [1, 2]. Disturbances in collagen fiber balance and disorganization of muscular structures lead to the formation of contractures, hypertrophic scars, and eversion of the lower lip, especially in the mobile part of the lip margin, which is constantly subjected to functional load [3].

Factors contributing to scar eversion include:

- the depth and area of the burn;
- the location of the injury;
- individual characteristics of tissue regeneration;
- concomitant infections and delayed treatment [4].

Everted scars of the lower lip are not only aesthetically noticeable but also functionally significant: they disrupt mouth closure, lead to chronic mucosal maceration, excessive salivation, and create conditions for recurrent inflammatory processes [5].

**Classification and Clinical Forms.** Modern classifications of post-burn scars identify several types of lip deformities:

- Contracture scars, which cause tissue retraction inward toward the oral cavity;
- Hypertrophic scars, resulting in thickening and induration of the lip;
- Eversions, where the edges of the lip turn outward, forming a chronic pathological condition [6, 7].

Each type of scar deformity requires an individualized treatment approach, making comprehensive therapy an essential element for successful restoration.

**Modern Treatment Methods.** Currently, the following groups of treatment approaches are applied:

1. Conservative methods — massage, physiotherapy, compression dressings, creams, and gels with regenerative effects [8].
2. Surgical correction — local and flap tissue transplantation, Z-plasty, use of microsurgical grafts [9].
3. Minimally invasive technologies — laser scar resurfacing, injection-based therapies, and stem cell applications [10].

Despite the wide range of available methods, treatment effectiveness is often limited due to recurrent scarring, insufficient restoration of lip mobility, and aesthetic defects. Therefore, developing comprehensive treatment programs that integrate preparatory measures, surgical correction, and postoperative rehabilitation remains a current and urgent task.

**Materials and Methods.** Due to the absence of original clinical data, this study proposes a conceptual model of comprehensive treatment for post-burn eversion scars of the lower lip,



based on the analysis of current literature and clinical guidelines [11–13]. The model consists of three main stages: preoperative preparation, surgical correction, and postoperative rehabilitation.

**Preoperative Preparation.** The goal of this stage is to improve the condition of scar tissue and create optimal conditions for subsequent surgical intervention. Recommended measures include:

- Gentle massage and compression therapy, which enhance microcirculation;
- Use of creams and gels with regenerative effects to reduce scar density;
- Assessment of lip mobility and peri-oral muscle condition to plan the surgical approach [14].

**Surgical Correction.** The surgical stage aims to restore the anatomical form and function of the lower lip. Key techniques include:

- Z-plasty and flap techniques to redistribute tension in scar tissue;
- Microsurgical grafts to replace lost skin and mucosa;
- Minimally invasive procedures, including laser resurfacing and injection therapies [15].

The main objectives of surgical correction are to restore lip contour, improve functional mobility, and reduce the risk of recurrent eversion.

**Postoperative Rehabilitation.** Rehabilitation ensures stabilization of surgical outcomes and prevents relapse:

- Physiotherapy methods (ultrasound, electrical stimulation);
- Regular exercises to restore facial and lip mobility;
- Monitoring scar condition and, if necessary, repeated use of compression therapy and topical regenerative agents;
- A multidisciplinary approach, involving a dentist, speech therapist, and rehabilitation specialist, to restore oral function and speech [16, 17].

**Ways to Improve Comprehensive Treatment.** Improving the outcomes of post-burn eversion scar treatment of the lower lip requires a multifaceted approach that integrates preparation, surgical intervention, and rehabilitation while addressing both functional and aesthetic aspects.

**Optimization of Preoperative Preparation.** Effective preoperative measures enhance tissue quality and reduce complications:

- Targeted physiotherapy and scar massage improve elasticity and blood supply to affected tissues;
- Topical regenerative agents can soften dense scars, making surgical manipulation safer and more effective;
- Detailed functional assessment of lip mobility and peri-oral muscles ensures individualized surgical planning [18].



Advanced Surgical Techniques. Modern surgical strategies focus on restoring anatomy and function while minimizing recurrence:

- Refined Z-plasty and local flap methods allow redistribution of tension lines, improving tissue alignment;
- Microvascular grafts and tissue engineering techniques provide durable coverage of defects and promote tissue integration;
- Minimally invasive procedures such as laser scar resurfacing and targeted injections accelerate tissue remodeling and improve postoperative aesthetics [19].

Postoperative Rehabilitation and Multidisciplinary Care. Comprehensive rehabilitation is critical for maintaining functional outcomes and preventing relapses:

- Early physiotherapy and exercises restore mimetic activity and lip mobility;
- Continuous monitoring of scar evolution enables timely interventions to correct emerging deformations;
- Multidisciplinary involvement, including speech therapists, dental specialists, and rehabilitation physicians, ensures restoration of speech, mastication, and facial expression;
- Adjunctive therapies, such as low-level laser therapy and controlled compression, reduce hypertrophic scarring and improve overall results [20, 21].

Integrating Novel Technologies. Future improvement may involve innovative regenerative approaches:

- Stem cell therapy and bioengineered dermal substitutes can enhance tissue regeneration and reduce scar formation;
- 3D imaging and planning improve surgical precision and outcomes;
- Patient-specific rehabilitation protocols, guided by functional assessment and digital modeling, increase the predictability of results.

By combining these strategies into a structured, evidence-informed treatment protocol, clinicians can achieve better functional recovery, aesthetic outcomes, and patient satisfaction, while minimizing recurrence and the need for repeated interventions.

**Discussion.** The analysis of current approaches to treating post-burn eversion scars of the lower lip highlights several challenges and opportunities. Despite a variety of surgical and conservative techniques, recurrence of scarring, limited mobility restoration, and aesthetic imperfections remain significant issues [1–10].

The proposed conceptual model emphasizes a comprehensive and individualized approach, integrating preoperative preparation, surgical correction, and postoperative rehabilitation. Evidence suggests that combining these elements improves functional outcomes and reduces the risk of re-eversion. Preoperative optimization of tissue quality and mobility allows more precise surgical manipulation, while postoperative rehabilitation consolidates the surgical results and restores mimetic activity [18–21].



Emerging technologies such as minimally invasive procedures, laser therapy, and regenerative medicine provide additional tools to enhance outcomes. Stem cell therapy and bioengineered dermal substitutes have demonstrated potential in improving tissue regeneration and reducing hypertrophic scarring. Furthermore, digital imaging and patient-specific planning enable surgeons to tailor interventions to individual anatomical and functional needs, increasing the predictability of results.

Overall, a multidisciplinary and evidence-informed strategy is essential for achieving optimal functional and aesthetic restoration, minimizing complications, and enhancing patient satisfaction. The implementation of standardized protocols combining traditional and innovative methods could lead to more consistent and reproducible outcomes across clinical settings.

## Conclusion

Post-burn eversion scars of the lower lip represent a complex clinical problem that affects both function and appearance. Effective management requires a comprehensive treatment approach, including preoperative tissue optimization, precise surgical correction, and structured postoperative rehabilitation.

The proposed pathways for improving comprehensive treatment include:

- Optimization of preoperative preparation;
- Application of advanced and minimally invasive surgical techniques;
- Multidisciplinary postoperative rehabilitation;
- Integration of novel regenerative and digital technologies.

These strategies can enhance functional recovery, improve aesthetic outcomes, prevent recurrence, and increase patient quality of life. Further clinical studies are needed to validate these conceptual approaches and to develop standardized, evidence-based protocols for routine practice.

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