

Reconstrucción facial y orofacial centrada en el paciente tras resección de cáncer cutáneo: integración de función, estética y calidad de vida

Patient-Centered Facial and Orofacial Reconstruction After Cutaneous Cancer Resection: Integrating Function, Aesthetics, and Quality of Life

Sandro José Nava Daza

UNIVERSIDAD NACIONAL AUTÓNOMA DE
MÉXICO

josendz.12@gmail.com

<https://orcid.org/0000-0001-8854-1482>

Erick Fernando Flores García

Escuela Superior Politécnica de Chimborazo
(ESPOCH)

osofloresgarcia@gmail.com

<https://orcid.org/0009-0000-3985-4407>

Luis Felipe Espinal Pérez

Independiente

Lufears@gmail.com

<https://orcid.org/0009-0000-6607-2128>

Oscar Emmanuel García Moreno

Universidad Juárez del Estado de Durango.

emmanuel_932@hotmail.com

<https://orcid.org/0009-0003-5987-4992>

Slendy Dayanna Gil Ayala

Universidad Autónoma de Bucaramanga

Sgil305@unab.edu.co

<https://orcid.org/0009-0000-4673-9319>

Diego Clemente Moreno

IMSS Hospital General Regional No. 2 El Marqués

dr.clementeesthetic@gmail.com

<https://orcid.org/0009-0003-1784-7486>

Gustavo Adrián Pineda Yañez

Universidad Antonio Nariño -Bogotá

tavitopineda19@gmail.com

<https://orcid.org/0009-0005-9101-9915>

Cristian Raziél Pacheco Hernandez

IMSS

drzazpach@gmail.com

<https://orcid.org/0009-0003-5072-3549>

Ashley Jesús García Cortes

Hospital General de México Dr. Eduardo Liceaga

ash.gaco921229@gmail.com

<https://orcid.org/0009-0005-1224-2036>

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***Autor de correspondencia:** josendz.12@gmail.com

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RESUMEN

La reconstrucción facial y orofacial posterior a la resección oncológica cutánea representa un desafío clínico complejo en el que el control tumoral debe integrarse con la preservación funcional, la restauración de la apariencia facial y el mantenimiento de la calidad de vida. Este estudio analizó las estrategias reconstructivas contemporáneas utilizadas después de la extirpación de cáncer cutáneo facial, con énfasis en la relación entre las características del defecto, la localización anatómica, la técnica quirúrgica, la recuperación funcional, la integración estética, las complicaciones postoperatorias y los resultados reportados por los pacientes. Se realizó una revisión estructurada bajo el marco del Método Científico, incorporando guías clínicas, revisiones sistemáticas, estudios observacionales, series reconstructivas e investigaciones centradas en resultados reportados por pacientes. Los hallazgos mostraron que el éxito reconstructivo depende principalmente de una planificación quirúrgica individualizada y no de la superioridad de una técnica única. El cierre primario, los injertos cutáneos, los colgajos locales, los colgajos regionales o por etapas y la transferencia libre microvascular presentan diferentes ventajas según el tamaño, profundidad, tejidos afectados y requerimientos funcionales del defecto. La reconstrucción nasal requiere preservar la permeabilidad de la vía aérea y el soporte estructural; la reconstrucción periocular prioriza la protección ocular y el cierre palpebral; y la reconstrucción labial y perioral exige conservar la competencia oral, el habla y la alimentación. La evidencia también demuestra que la supervivencia del colgajo y la cicatrización son insuficientes para definir el éxito. Deben considerarse integración estética, complicaciones, satisfacción, bienestar psicológico y reintegración social. En conjunto, los resultados respaldan un enfoque multidimensional y centrado en el paciente que equilibre seguridad oncológica, función, estética y calidad de vida.

PALABRAS CLAVE

reconstrucción facial, reconstrucción orofacial, cáncer cutáneo, resección oncológica, cirugía de Mohs, colgajos locales, injertos cutáneos, reconstrucción microvascular, resultados funcionales, resultados estéticos, calidad de vida, resultados reportados por pacientes

ABSTRACT

Facial and orofacial reconstruction following cutaneous oncologic resection represents a complex clinical challenge in which tumor control must be integrated with preservation of function, restoration of facial appearance, and maintenance of quality of life. This study analyzed contemporary reconstructive strategies used after facial skin cancer excision, with emphasis on the relationship between defect characteristics, anatomical location, surgical technique, functional recovery, aesthetic integration, postoperative complications, and patient-reported outcomes. A structured review was conducted under the Scientific Method framework, incorporating clinical guidelines, systematic reviews, observational studies, reconstructive case series, and investigations focused on patient-reported outcomes. The findings showed that reconstructive success depends primarily on individualized surgical planning rather than on the superiority of a single technique. Primary closure, skin grafts, local flaps, regional or staged flaps, and microvascular free-tissue transfer provide different advantages according to defect size, depth, tissue involvement, and functional requirements. Nasal reconstruction requires preservation of airway patency and structural support; periocular reconstruction prioritizes ocular protection and eyelid closure; and lip and perioral reconstruction requires maintenance of oral competence, speech, and feeding. The evidence also demonstrated that flap survival and wound healing alone are insufficient to define successful reconstruction. Aesthetic integration, complication burden, patient satisfaction, psychological well-being, and social reintegration must also be considered. Patient-reported outcome measures, including the FACE-Q Skin Cancer Module, strengthen the assessment of reconstructive effectiveness. Overall, the evidence supports a multidimensional and patient-centered approach in which oncologic safety, function, aesthetics, and quality of life are balanced to achieve comprehensive recovery after facial and orofacial cancer surgery.

KEYWORDS

facial reconstruction, orofacial reconstruction, skin cancer, oncologic resection, Mohs surgery, local flaps, skin grafts, microvascular reconstruction, functional outcomes, aesthetic outcomes, quality of life, patient-reported outcomes

INTRODUCCIÓN

Cutaneous malignancies of the face constitute a particularly complex oncologic and reconstructive problem because tumor eradication must be achieved within an anatomical region in which relatively small defects may generate substantial functional, aesthetic, psychological, and social consequences. The face is not only the most visible component of personal identity, but also contains highly specialized anatomical structures responsible for fundamental functions such as oral competence, mastication, speech, swallowing, facial expression, nasal airflow, ocular protection, and sensory interaction with the environment. Consequently, surgical treatment of facial skin cancer cannot be evaluated solely according to oncologic clearance. The quality of reconstruction after tumor removal has become an essential component of comprehensive cancer care, particularly when resections involve the nose, lips, eyelids, cheeks, forehead, perioral tissues, or several facial aesthetic units simultaneously (Chen et al., 2021; Desisto et al., 2023; Zimmer et al., 2023).

Nonmelanoma skin cancers, particularly basal cell carcinoma and cutaneous squamous cell carcinoma, frequently develop in chronically sun-exposed regions of the head and neck. Although many lesions can be treated successfully with conventional excision or Mohs micrographic surgery, tumor characteristics such as size, recurrence, aggressive histological subtype, poorly defined margins, perineural involvement, or location within anatomically constrained facial regions may result in defects that extend beyond the skin to involve subcutaneous tissue, muscle, cartilage, mucosa, or bone. Reconstruction therefore ranges from direct closure and skin grafting to local tissue rearrangement, regional flaps, staged interpolated flaps, cartilage grafts, and, in selected extensive defects, microvascular free-tissue transfer (Chen et al., 2021; Egeler et al., 2019; Zimmer et al., 2023). Selecting among these options represents a clinically relevant challenge because technically successful wound closure does not necessarily correspond to optimal functional recovery, facial appearance, or patient satisfaction.

The reconstructive problem becomes particularly important when oncologic resections disrupt specialized facial subunits. Nasal defects, for example, require consideration not only of external coverage but also of structural support and internal lining when deeper tissues have been removed. Failure to restore these components appropriately may lead to nasal valve collapse, contour abnormalities, retraction, airway obstruction, or conspicuous distortion of adjacent subunits. Contemporary nasal reconstruction therefore emphasizes defect depth, size, anatomical subunit, cartilage support, vascularity, and the relationship between reconstructed tissues and surrounding facial landmarks (Losco et al., 2020). Large clinical experiences with post-oncologic nasal reconstruction have demonstrated that individualized selection of local flaps, grafts, and staged forehead flap techniques is fundamental for restoring facial contour while simultaneously maintaining structural and respiratory function (Halani et al., 2021; Sanniec et al., 2017).

Similarly, reconstruction of the lips and perioral region requires a delicate balance between tissue replacement and preservation of sphincter function. Even limited defects may alter oral continence, articulation, facial expression, commissure position, and the ability to manipulate food during mastication. Larger resections can produce microstomia, drooling, asymmetry, sensory impairment, and difficulties with speech or nutritional intake. Accordingly, reconstructive planning must account for the percentage of lip involved, defect orientation, commissural involvement, mucosal loss, muscular continuity, and the possibility of restoring functional orbicularis oris mechanics. Clinical experience with large cohorts of patients undergoing post-Mohs lip reconstruction has reinforced the principle that reconstruction should be directed toward restoration of both oral competence and acceptable facial proportions rather than toward simple defect coverage alone (Sanniec et al., 2020).

Periocular defects create another distinct reconstructive challenge because the eyelids are responsible for corneal protection, tear-film distribution, ocular surface maintenance, and appropriate lacrimal drainage. Reconstruction that appears aesthetically acceptable but causes ectropion, entropion, lagophthalmos, eyelid malposition, or inadequate globe coverage may considerably compromise visual function and quality of life. Systematic assessments of periocular

reconstruction after Mohs surgery and oncologic excision have therefore emphasized restoration of eyelid stability, lamellar anatomy, canthal support, and functional closure as fundamental outcomes alongside scar quality and symmetry (Archibald et al., 2023; Patel & Itani, 2018). These examples demonstrate that facial reconstruction after cutaneous oncologic surgery cannot be approached using a single universal algorithm; rather, reconstructive decisions must be adapted to the distinct functional and aesthetic demands of each facial region.

The concept of facial aesthetic subunits has consequently become central to reconstructive planning. The nose, eyelids, lips, cheeks, forehead, and chin possess characteristic contours, junctions, skin thicknesses, textures, and patterns of light reflection that influence how reconstructed defects are perceived. Local flaps are particularly useful because they recruit adjacent tissue with similar color, thickness, texture, vascularity, and sebaceous characteristics. However, their use also requires careful attention to tension vectors, scar placement, distortion of nearby structures, and displacement of natural landmarks. Larger or composite defects may necessitate combined local flaps or staged reconstruction to achieve adequate tissue replacement without sacrificing function (Johnson et al., 2019; Taibo & Cabrera-Sarmiento, 2025). Thus, reconstructive success depends not merely on closing the surgical wound but on recreating the anatomical relationships that allow the reconstructed region to reintegrate visually and functionally into the face.

The clinical relevance of this issue has increased as oncologic treatment outcomes have improved and greater attention has shifted toward survivorship and long-term patient-centered outcomes. Historically, surgical success in cutaneous oncology was predominantly defined by complete tumor excision, acceptable complication rates, and absence of recurrence. These remain indispensable outcomes, yet they provide an incomplete representation of recovery. A patient may remain tumor-free while experiencing persistent dissatisfaction with appearance, facial asymmetry, altered expression, functional limitation, social avoidance, or diminished self-confidence. The consequences of facial deformity can extend beyond conventional surgical endpoints because facial appearance plays an important role in communication and interpersonal perception. Experimental evidence has demonstrated that visible facial defects may negatively influence how individuals are socially perceived and that high-quality reconstruction may reduce these negative perceptions (Dey, Ishii, Byrne, et al., 2015; Dey, Ishii, Boahene, et al., 2015).

For this reason, modern facial reconstruction increasingly incorporates patient-reported outcomes into evaluation of surgical success. Measures of satisfaction with appearance, scar perception, psychological distress, social confidence, and health-related quality of life provide information that cannot be obtained exclusively through clinician assessment or standardized postoperative photographs. The development of the FACE-Q Skin Cancer Module represented an important methodological advance by providing a condition-specific instrument capable of measuring patient-reported outcomes after facial skin cancer surgery (Lee et al., 2018). Subsequent validation and application of the instrument have supported its usefulness in evaluating reconstructive outcomes across different clinical settings and populations (Dobbs et al., 2021). Moreover, patient expectations appear to influence postoperative satisfaction, suggesting that the subjective experience of reconstruction is shaped not only by surgical anatomy but also by preoperative counseling, anticipated appearance, individual priorities, and perception of treatment results (Blank et al., 2020).

This patient-centered perspective is especially important because objective aesthetic assessment and patient satisfaction do not always correspond. Surgeons may evaluate symmetry, scar visibility, contour restoration, color match, structural support, and anatomical proportions, whereas patients may assign greater importance to recognizability, social confidence, preservation of expression, avoidance of conspicuous deformity, or ability to resume normal activities. Consequently, a technically sophisticated reconstruction does not automatically guarantee an optimal quality-of-life outcome. Conversely, modest residual asymmetry may be well tolerated when functional preservation is excellent and patient expectations have been appropriately established. These observations support a multidimensional definition of reconstructive success that incorporates oncologic safety, complication prevention, functional preservation, aesthetic integration, patient satisfaction, and psychosocial recovery.

The complexity of this balance becomes even greater in extensive orofacial defects requiring advanced reconstructive techniques. When cancer resection removes multiple tissue types or creates significant three-dimensional defects, local tissues may be insufficient to achieve restoration of both form and function. Microvascular free-flap reconstruction can provide vascularized skin, fascia, muscle, and bone according to the specific characteristics of the defect. In head and neck oncologic surgery, these techniques have substantially expanded reconstructive possibilities and may facilitate restoration of speech, swallowing, oral separation, mandibular continuity, and facial contour. Nevertheless,

the success of free-tissue transfer should also be analyzed from the perspective of long-term quality of life rather than only flap survival. Systematic evidence examining patients after head and neck cancer surgery and free-flap reconstruction indicates that functional, psychological, and social outcomes remain major determinants of postoperative well-being (Gosselin et al., 2024). Although extensive mucosal head and neck malignancies differ from primarily cutaneous facial cancers, the broader reconstructive principles derived from these studies remain relevant when cutaneous tumors produce major composite or orofacial defects.

Recent literature has increasingly attempted to establish evidence-based reconstructive strategies. The clinical practice guideline developed by Chen et al. (2021) synthesized evidence concerning reconstruction after skin cancer resection and reinforced the need to consider defect characteristics, anatomical site, reconstructive modality, and patient-specific factors when determining treatment. More recent reviews have highlighted persistent variability in the quality of available evidence and have emphasized the need for stronger comparisons among reconstructive approaches, particularly with respect to functional outcomes, aesthetic assessment, complications, and patient-reported measures (Desisto et al., 2023; Zimmer et al., 2023). This limitation is relevant because many publications focus on technical descriptions, retrospective case series, or surgeon-reported outcomes, while fewer studies simultaneously assess function, aesthetics, and quality of life.

The existing evidence is particularly heterogeneous regarding how outcomes are defined. Some studies emphasize flap survival, infection, hematoma, necrosis, dehiscence, or revision surgery; others evaluate nasal obstruction, oral competence, eyelid position, or sensory disturbances. Aesthetic results may be assessed by clinicians, independent observers, photographic analysis, or patients themselves, using different rating systems. Quality of life may similarly be measured with general oncology instruments, dermatology-specific scales, head and neck cancer questionnaires, or facial surgery instruments such as FACE-Q. Such methodological variability makes direct comparison between reconstructive strategies difficult and may obscure the relationship between anatomical reconstruction and the outcomes that matter most to patients. This heterogeneity constitutes an important justification for synthesizing the evidence through a framework focused on the interaction among functional restoration, aesthetic outcome, and quality of life.

Moreover, the optimal reconstructive strategy is influenced by variables beyond the defect itself. Age, frailty, tobacco exposure, vascular status, diabetes, immunosuppression, previous surgery, radiation exposure, anticoagulant use, patient preferences, tumor recurrence risk, and capacity to undergo multiple procedures may all affect decision-making. A staged forehead flap may provide an excellent aesthetic result for a complex nasal defect but require several operations. A single-stage reconstruction may be preferable in a medically fragile patient even when the aesthetic result is potentially less refined. Likewise, extensive local tissue rearrangement may offer excellent color and texture match but risk distortion of adjacent structures if poorly designed. Reconstruction must therefore be individualized according to the relationship among anatomical requirements, oncologic considerations, surgical burden, expected functional benefit, aesthetic goals, and patient priorities.

The importance of timing should also be recognized. Immediate reconstruction after margin-controlled oncologic resection may reduce patient distress, shorten the period of visible deformity, and allow reconstruction before fibrosis develops. However, complex tumors, uncertain margins, recurrent disease, or circumstances requiring additional oncologic treatment may modify the reconstructive plan. Close coordination between dermatologic surgeons, surgical oncologists, plastic and reconstructive surgeons, facial plastic surgeons, maxillofacial surgeons, ophthalmic specialists, and other members of the multidisciplinary team may therefore improve the capacity to anticipate defect characteristics and select an appropriate reconstructive strategy. Multidisciplinary planning becomes particularly relevant when reconstruction must restore several functional domains simultaneously.

Another challenge lies in establishing the relative importance of aesthetic perfection compared with functional preservation. In facial surgery these outcomes are often inseparable. Restoration of nasal contour may simultaneously stabilize the airway; appropriate lower eyelid position can improve facial symmetry while protecting the ocular surface; reconstruction of the oral commissure influences both appearance and oral competence. Consequently, the traditional separation between “functional” and “cosmetic” surgery may be conceptually insufficient in post-oncologic facial reconstruction. Aesthetic restoration can have functional and psychosocial consequences, while functional reconstruction strongly influences perceived appearance and social reintegration. A more appropriate framework is

therefore to consider function, aesthetics, and quality of life as interdependent domains rather than competing endpoints.

Contemporary studies of post-Mohs reconstruction illustrate this multidimensional relationship. Large series have provided valuable information about reconstructive patterns and complication profiles in nasal and lip surgery (Halani et al., 2021; Sanniec et al., 2020), while investigations specifically assessing nasal reconstruction have increasingly examined both functional and aesthetic outcomes rather than restricting analysis to flap viability or wound healing (Alexander et al., 2025; Wang et al., 2025). Similarly, the increasing use of patient-reported instruments demonstrates a broader transition from procedure-centered evaluation toward outcomes that reflect the patient's lived experience (Lee et al., 2018). Nevertheless, these dimensions are still frequently studied independently, creating a gap between technical reconstructive literature and comprehensive patient-centered assessment.

Against this background, the central research problem addressed in this study is how reconstructive strategies following cutaneous oncologic resection of the facial and orofacial regions can achieve an optimal balance among functional preservation, aesthetic restoration, and postoperative quality of life. The primary research question is: **Which reconstructive principles and techniques most effectively integrate oncologic safety, functional recovery, aesthetic outcomes, and patient-reported quality of life after facial and orofacial cutaneous cancer resection?** Secondary questions include whether specific reconstructive approaches provide advantages according to anatomical subunit and defect complexity; which functional outcomes should be prioritized in nasal, periocular, perioral, and composite defects; how aesthetic outcomes interact with psychological and social recovery; and which patient-reported measures are most useful for evaluating reconstructive success.

The working hypothesis is that optimal post-oncologic facial reconstruction is not determined by a single surgical technique but by individualized selection based on defect location, depth, tissue composition, functional requirements, aesthetic subunits, patient comorbidities, and personal expectations. It is further hypothesized that reconstructive strategies designed according to these multidimensional criteria produce more favorable overall outcomes than approaches evaluated primarily through wound closure or surgeon-assessed aesthetic appearance. A related hypothesis is that the incorporation of validated patient-reported outcome measures improves understanding of reconstructive success by identifying dimensions of recovery that may not be apparent through conventional clinical assessment.

To address these questions, the study adopts a structured review-based design focused on contemporary evidence concerning facial and orofacial reconstruction following cutaneous oncologic surgery. The analytical strategy integrates evidence from clinical practice guidelines, systematic reviews, retrospective and prospective clinical series, reconstructive outcome studies, and investigations using patient-reported outcome measures. Particular attention is given to reconstruction of anatomically and functionally critical facial regions, including the nose, eyelids, lips, perioral tissues, cheeks, and complex composite defects. Reconstructive approaches are analyzed according to defect characteristics, surgical technique, complications, functional preservation, aesthetic integration, and quality-of-life outcomes. This design is aligned with the research hypothesis because it allows reconstructive success to be examined as a multidimensional phenomenon rather than as an isolated technical endpoint.

The methodological approach also recognizes that direct randomized comparisons among reconstructive techniques are often impractical because facial defects differ substantially in size, depth, location, tissue involvement, oncologic characteristics, and patient-related factors. Consequently, evidence must be interpreted within the anatomical and clinical context in which each reconstructive strategy is applied. Rather than identifying a universally superior flap or graft, the study seeks to determine the principles that guide appropriate technique selection and the outcome domains that should be considered when evaluating reconstruction. This approach is consistent with the individualized nature of reconstructive surgery and with current evidence indicating that treatment planning must be adapted to both defect-specific and patient-specific variables (Chen et al., 2021; Desisto et al., 2023).

Ultimately, facial and orofacial reconstruction after cutaneous cancer resection represents a transition from oncologic defect management toward comprehensive restoration of the patient. The surgical objective is no longer limited to replacing missing tissue; it encompasses preservation of essential facial functions, recreation of anatomical relationships, minimization of visible deformity, maintenance of identity, and facilitation of psychological and social recovery. As survival and local tumor control continue to improve, these long-term outcomes acquire increasing

importance. A comprehensive evaluation of reconstructive strategies through the combined lenses of function, aesthetics, and quality of life is therefore necessary to support evidence-based decision-making, strengthen multidisciplinary care, and establish reconstructive goals that reflect both surgical priorities and the outcomes most meaningful to patients.

DESARROLLO

Facial and orofacial reconstruction after cutaneous oncologic resection represents a complex intersection between tumor control, restoration of anatomy, preservation of function, and recovery of patient identity. Although complete oncologic excision remains the primary therapeutic objective, the resulting defect may compromise structures that are essential for respiration, ocular protection, oral competence, speech, swallowing, mastication, facial expression, and social interaction. Therefore, reconstructive planning should begin at the time of tumor assessment and should consider both the anticipated extent of resection and the functional consequences of tissue loss (Chen et al., 2021; Zimmer et al., 2023).

The reconstructive strategy is determined by several variables, including defect size, depth, anatomical location, involvement of cartilage, muscle, mucosa or bone, previous surgery, tissue quality, comorbidities, and patient expectations. Small superficial defects may be managed by secondary healing, primary closure, or skin grafting, whereas larger or deeper defects frequently require local flaps, regional flaps, composite grafts, or microvascular free-tissue transfer. Evidence from head and neck reconstruction indicates that local tissue rearrangement remains particularly valuable because adjacent skin frequently provides superior similarity in color, thickness, texture, and vascular characteristics (Egeler et al., 2019; Johnson et al., 2019).

Nasal reconstruction illustrates the importance of restoring both form and function. The nose is composed of several aesthetic subunits and contains structural elements necessary to maintain airway patency. Defects affecting cartilage or the nasal lining may therefore require multilayer reconstruction rather than simple external coverage. Selection of local flaps, cartilage grafts, or staged forehead flaps depends on defect location and depth, with the objective of preventing contour deformity, airway obstruction, alar retraction, or nasal valve collapse (Losco et al., 2020; Halani et al., 2021). Large clinical series have shown that individualized reconstructive planning can produce satisfactory structural and aesthetic outcomes when the defect is evaluated according to anatomical subunit and tissue requirements (Sanniec et al., 2017).

The perioral region presents different challenges because reconstruction must preserve continuity of the orbicularis oris muscle and maintain oral competence. Loss of lip tissue can lead to drooling, impaired articulation, difficulty eating, commissural distortion, or microstomia. Consequently, reconstructive techniques should be selected according to the proportion of the lip involved, depth of resection, commissural involvement, and need for mucosal and muscular restoration. Experience with post-Mohs lip defects demonstrates that successful reconstruction depends on maintaining both functional sphincter activity and appropriate lip symmetry (Sanniec et al., 2020).

Similarly, periocular reconstruction requires careful restoration of eyelid anatomy. Even small abnormalities in eyelid position can cause exposure keratopathy, tearing disorders, ectropion, entropion, or incomplete eyelid closure. Reconstructive planning must therefore maintain structural support, canthal stability, lamellar continuity, and adequate movement. Systematic reviews emphasize that successful periocular reconstruction should be evaluated according to both aesthetic symmetry and preservation of ocular protection (Archibald et al., 2023; Patel & Itani, 2018).

Aesthetic considerations are inseparable from functional outcomes. Facial reconstruction seeks to place scars along natural creases, respect aesthetic subunits, maintain symmetry, and minimize distortion of adjacent structures. Local flaps are particularly useful for achieving these goals because they allow tissue with similar characteristics to be transferred into the defect. However, inappropriate flap design can generate excessive tension, displacement of facial landmarks, or secondary deformity. The choice of reconstructive technique must therefore account for tension vectors, vascular supply, tissue mobility, and the expected postoperative contour (Johnson et al., 2019; Taibo & Cabrera-Sarmiento, 2025).

Beyond physical reconstruction, facial cancer surgery may affect psychological well-being and social interaction. Visible facial defects can influence self-image, interpersonal perception, and confidence. Studies evaluating social

responses to facial deformity have demonstrated that reconstruction can reduce negative perceptions associated with visible defects, reinforcing the importance of achieving not only wound closure but also meaningful restoration of facial appearance (Dey, Ishii, Byrne, et al., 2015; Dey, Ishii, Boahene, et al., 2015).

Patient-reported outcomes have therefore become increasingly relevant in reconstructive assessment. The FACE-Q Skin Cancer Module provides a structured method for evaluating satisfaction with facial appearance, scars, psychological effects, and patient experience after skin cancer surgery (Lee et al., 2018). Subsequent research has confirmed that postoperative satisfaction is influenced by both the physical result and preoperative expectations, demonstrating that communication and shared decision-making are essential components of reconstructive care (Blank et al., 2020; Dobbs et al., 2021).

For extensive defects involving multiple tissue layers, microvascular reconstruction may be required. Free flaps can provide skin, soft tissue, muscle, fascia, or bone according to the characteristics of the oncologic defect. These procedures increase the possibilities for restoring complex three-dimensional anatomy, but they also introduce greater operative demands and potential morbidity. In such cases, treatment success should be assessed through long-term functional recovery and quality of life rather than exclusively by flap survival (Gosselin et al., 2024).

OBJETIVO GENERAL Y OBJETIVOS ESPECÍFICOS

General Objective

To **analyze and integrate** the main reconstructive strategies used after facial and orofacial cutaneous oncologic resection, evaluating their capacity to preserve function, optimize aesthetic outcomes, and improve patient quality of life through an evidence-based and patient-centered approach.

Specific Objectives

Cognitive Domain

1. To **identify** the principal anatomical, oncologic, and reconstructive factors that influence surgical planning after facial and orofacial skin cancer resection.
2. To **compare** reconstructive alternatives, including primary closure, skin grafts, local and regional flaps, staged procedures, and microvascular free-tissue transfer, according to defect location, depth, complexity, and expected outcomes.
3. To **analyze** the functional requirements associated with reconstruction of the nose, eyelids, lips, perioral region, cheeks, and complex composite facial defects.
4. To **evaluate** the available evidence regarding complications, functional recovery, aesthetic results, patient satisfaction, and quality of life after reconstructive surgery (Chen et al., 2021; Desisto et al., 2023).

Psychomotor Domain

5. To **organize and apply** a systematic framework for classifying facial defects according to anatomical subunit, size, depth, tissue involvement, and functional consequences.
6. To **construct** a reproducible decision-making sequence that facilitates selection of the most appropriate reconstructive technique according to the characteristics of the oncologic defect.
7. To **integrate** clinical outcome indicators and patient-reported measures, including tools such as the FACE-Q Skin Cancer Module, into the assessment of reconstructive effectiveness (Lee et al., 2018).

Affective Domain

8. To **recognize** the importance of patient preferences, expectations, body image, and psychosocial well-being in reconstructive decision-making.
9. To **value** shared decision-making and multidisciplinary collaboration as essential components of comprehensive facial oncologic reconstruction.
10. To **promote** a reconstructive approach that prioritizes oncologic safety while respecting functional independence, facial identity, aesthetic integration, and long-term quality of life.

OBJETO DE ESTUDIO

The object of study is the **reconstructive management of facial and orofacial defects resulting from cutaneous oncologic resection**, with particular emphasis on the relationship between surgical technique, functional preservation, aesthetic restoration, and postoperative quality of life.

The phenomenon under investigation includes reconstructive procedures performed after the removal of malignant cutaneous tumors affecting anatomically relevant regions such as the **nose, eyelids, lips, perioral tissues, cheeks, forehead, and complex composite facial units**. These defects may involve skin alone or extend to subcutaneous tissue, muscle, cartilage, mucosa, and bone, producing different degrees of functional and aesthetic impairment (Chen et al., 2021; Zimmer et al., 2023).

The population of interest comprises **adult patients undergoing facial or orofacial reconstruction following oncologic excision of cutaneous malignancies**, particularly basal cell carcinoma and cutaneous squamous cell carcinoma, including patients treated with conventional excision or Mohs micrographic surgery. Cases requiring simple closure, grafting, local or regional flaps, staged reconstruction, or microvascular free-tissue transfer are considered within the scope of analysis.

The study focuses on four main outcome dimensions: **oncologic safety, functional recovery, aesthetic outcome, and quality of life**. Functional variables include nasal airway preservation, ocular protection, oral competence, speech, swallowing, mastication, and facial mobility. Aesthetic variables include symmetry, contour, scar visibility, color and texture match, preservation of facial landmarks, and integration within aesthetic subunits. Quality-of-life outcomes include patient satisfaction, body image, psychological well-being, social confidence, and patient-reported outcomes assessed through validated instruments such as the FACE-Q Skin Cancer Module (Lee et al., 2018).

Therefore, the unit of analysis is not limited to a specific reconstructive technique, but rather to the **decision-making process and clinical outcomes associated with selecting the most appropriate reconstructive strategy according to defect characteristics and patient needs**. This approach allows reconstruction to be evaluated as a multidimensional therapeutic process in which successful cancer treatment must be accompanied by preservation of function, facial identity, and long-term well-being (Desisto et al., 2023).

METODOLOGÍA

This study was conducted using the **Scientific Method** as the principal methodological framework, applied to a structured review of the contemporary evidence on facial and orofacial reconstruction after cutaneous oncologic resection. This methodology was selected because it allows the research problem to be approached through systematic observation, formulation of research questions and hypotheses, collection of relevant evidence, comparative analysis, and interpretation of findings according to predefined clinical variables.

The review focused on scientific publications addressing reconstruction after facial skin cancer excision, including procedures performed after conventional oncologic resection and Mohs micrographic surgery. Evidence was considered from clinical practice guidelines, systematic reviews, retrospective and prospective observational studies, reconstructive case series, and studies evaluating patient-reported outcomes.

The literature search was structured around the following conceptual domains: **facial skin cancer, Mohs surgery, facial reconstruction, orofacial reconstruction, local flaps, skin grafts, nasal reconstruction, lip reconstruction, periocular reconstruction, free-flap reconstruction, aesthetic outcomes, functional outcomes, and quality of life.** Priority was given to peer-reviewed publications with direct clinical relevance to post-oncologic facial reconstruction and to studies evaluating functional, aesthetic, psychological, or patient-reported outcomes (Chen et al., 2021; Desisto et al., 2023).

Studies were included when they met at least one of the following criteria: evaluation of reconstructive techniques after facial cutaneous malignancy removal; description of functional or aesthetic outcomes; analysis of complications or reconstructive success; assessment of patient satisfaction or quality of life; or presentation of evidence-based recommendations for facial reconstruction. Studies unrelated to oncologic facial defects or lacking clinically relevant reconstructive outcomes were excluded.

For data extraction, each publication was evaluated according to anatomical region, defect characteristics, reconstructive technique, functional outcomes, aesthetic results, postoperative complications, and patient-reported outcomes. Particular attention was given to nasal, periocular, lip, perioral, and complex facial defects because these areas present substantial functional and aesthetic demands (Halani et al., 2021; Sanniec et al., 2020; Archibald et al., 2023).

The extracted evidence was organized into comparative analytical categories. Reconstructive techniques were examined according to their capacity to achieve tissue coverage, preserve specialized facial functions, maintain anatomical landmarks, minimize complications, and provide satisfactory aesthetic integration. Patient-centered outcomes were incorporated through studies employing validated instruments such as the **FACE-Q Skin Cancer Module**, which provides information regarding satisfaction with facial appearance, scars, psychological well-being, and postoperative experience (Lee et al., 2018; Dobbs et al., 2021).

To improve methodological reproducibility, the review process followed a predefined sequence: formulation of the research question, identification of relevant literature, application of inclusion and exclusion criteria, extraction of predefined variables, organization of evidence by reconstructive domain, comparative analysis, and synthesis of clinically relevant findings. This sequence allows other investigators to reproduce the same methodological approach using equivalent databases, search terms, eligibility criteria, and analytical variables.

The methodological design was aligned with the study hypothesis that successful facial reconstruction should not be evaluated exclusively through surgical closure or flap survival, but through the combined assessment of **functional preservation, aesthetic restoration, and quality of life.** Therefore, the analysis integrated objective surgical outcomes with patient-centered measures to obtain a more comprehensive evaluation of reconstructive effectiveness.

FASES DEL DESARROLLO

Phase 1. Identification of the Research Problem

The first phase consisted of defining the central problem: reconstructive success after facial cancer resection cannot be evaluated exclusively through wound closure or flap survival. Because the face concentrates structures responsible for breathing, oral competence, vision protection, expression, and social interaction, reconstruction must simultaneously address oncologic safety, function, appearance, and quality of life (Chen et al., 2021; Zimmer et al., 2023).

Phase 2. Formulation of the Research Question and Hypothesis

The research question was formulated to determine which reconstructive principles and techniques provide the most appropriate balance between **functional preservation, aesthetic restoration, and quality of life** after cutaneous oncologic resection.

The working hypothesis proposed that the best outcomes are achieved through individualized reconstruction based on defect location, size, depth, tissue involvement, functional requirements, aesthetic subunits, comorbidities, and patient expectations rather than through the routine application of a single reconstructive technique.

Phase 3. Collection of Scientific Evidence

Relevant scientific literature was identified using concepts related to facial skin cancer, Mohs surgery, facial and orofacial reconstruction, local and regional flaps, skin grafts, microvascular reconstruction, functional outcomes, aesthetic outcomes, and patient-reported quality of life.

Priority was given to clinical guidelines, systematic reviews, observational studies, reconstructive series, and studies evaluating patient-reported outcomes. Evidence involving nasal, lip, periocular, perioral, and complex facial reconstruction was specifically considered because of the functional and aesthetic relevance of these regions (Halani et al., 2021; Sanniec et al., 2020; Archibald et al., 2023).

Phase 4. Classification and Organization of Evidence

The selected evidence was organized according to the main variables of interest:

- Anatomical region and facial aesthetic subunit.
- Size and depth of the oncologic defect.
- Tissue components affected.
- Reconstructive technique employed.
- Functional outcomes.
- Aesthetic outcomes.
- Postoperative complications.
- Patient satisfaction and quality of life.

This classification permitted comparison of reconstructive strategies under equivalent clinical domains.

Phase 5. Comparative Analysis

The reconstructive techniques were comparatively analyzed according to their ability to restore tissue coverage, structural support, facial symmetry, and specialized functions. Local flaps, grafts, staged reconstructions, and microvascular techniques were evaluated according to defect complexity and the advantages and limitations described in the literature (Desisto et al., 2023).

Special attention was given to the relationship between objective surgical outcomes and patient perception because technically satisfactory reconstruction does not always correspond to optimal psychological or social recovery. Patient-reported measures such as the **FACE-Q Skin Cancer Module** were therefore incorporated into the analytical framework (Lee et al., 2018).

Phase 6. Interpretation and Integration of Findings

The evidence was subsequently integrated to identify common reconstructive principles. The analysis emphasized preservation of anatomical function, respect for facial aesthetic subunits, prevention of distortion, adequate tissue matching, reduction of complications, and incorporation of patient expectations into surgical planning.

Rather than establishing a single superior reconstructive technique, the findings were interpreted according to the principle that reconstruction must be individualized to the characteristics of the defect and the patient.

Phase 7. Evaluation of the Initial Hypothesis

Finally, the findings were contrasted with the working hypothesis. The available evidence was assessed to determine whether individualized reconstructive planning provides a more comprehensive model of success than approaches based primarily on technical closure or surgeon-reported appearance.

The final synthesis considered **oncologic safety, function, aesthetics, complications, patient satisfaction, and quality of life** as complementary indicators of successful facial and orofacial reconstruction.

RESULTADOS Y DISCUSIÓN

Figure 1.

Relationship between defect complexity and the principal reconstructive strategies used after facial cutaneous oncologic resection.

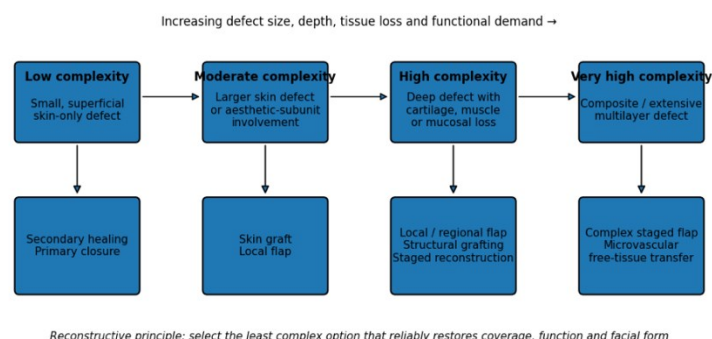


Figure 1 summarizes the progressive relationship between the **complexity of the facial defect produced by oncologic resection and the reconstructive resources required to restore it**. The diagram should be interpreted as a clinical decision framework rather than as a rigid reconstructive ladder. Defect size is important, but it is not the only determinant of complexity. Depth, anatomical subunit, involvement of cartilage, muscle or mucosa, proximity to free margins, functional requirements, tissue quality, and individual patient characteristics may substantially modify the final reconstructive choice. Evidence-based recommendations therefore support individualized planning rather than the systematic use of a particular closure technique for every defect (Chen et al., 2021; Desisto et al., 2023).

At the lowest level of complexity, **small and superficial skin-only defects** can frequently be managed with secondary intention healing or primary linear closure when sufficient tissue mobility is available and closure does not distort adjacent anatomical structures. These approaches minimize operative morbidity and avoid unnecessary tissue transfer. Nevertheless, their suitability depends heavily on location. A relatively small defect positioned near the eyelid margin, nasal ala, oral commissure, or another mobile facial landmark may require a more sophisticated reconstruction because even limited tension can produce functional distortion. Therefore, the transition from one category to another in the figure reflects increasing reconstructive requirements rather than an absolute defect-size threshold.

Evidence from clinical series illustrates the importance of adapting reconstruction to the characteristics of the defect. Egeler et al. (2019) evaluated **418 adult patients** undergoing reconstruction after Mohs micrographic surgery of the head and neck. The nasal aesthetic unit was affected in approximately **50% of cases**, local advancement flaps were used in **51%**, and grafts in **25%**. The reported complication rate was approximately **3%**, while scar revision was required in approximately **6%** of patients. These results demonstrate both the frequent use of relatively conservative local reconstructive techniques and the importance of considering the facial aesthetic unit when selecting treatment (Egeler et al., 2019).

As defect complexity increases, **skin grafts and local flaps** become particularly relevant. Skin grafts can provide reliable coverage when the wound bed is adequately vascularized, while local flaps transfer adjacent tissue that frequently offers superior similarity in skin thickness, texture, pigmentation, and sebaceous characteristics. This tissue similarity is especially important on the face, where discrepancies in contour or surface characteristics may remain

highly visible. Local flaps can also reposition scars along natural facial boundaries and redistribute tension away from critical structures. However, their use requires detailed knowledge of vascular anatomy and tension vectors because poorly oriented tissue movement can produce secondary displacement of the nasal ala, eyelid, vermilion border, or oral commissure.

The transition toward **high-complexity defects** occurs when oncologic resection extends beyond superficial skin and involves deeper structural tissues. Cartilage loss may require structural grafting to prevent collapse, while muscle or mucosal loss may demand restoration of dynamic or internal lining components. At this level, reconstruction becomes fundamentally three-dimensional: successful treatment must restore not simply external coverage, but also support, contour and specialized function. Consequently, local or regional flaps may be combined with cartilage grafts, mucosal reconstruction, or staged procedures.

Nasal reconstruction provides a particularly clear example. In the large series by Halani et al. (2021), **2,553 nasal reconstruction cases were identified**, with 1,550 included in the detailed analysis. The nasal ala was the most commonly affected location, accounting for **48.1% of defects**, while **74.8% were skin-only defects**. Full-thickness skin grafts represented **36.2%** of reconstructions, forehead flaps **24.4%**, and nasolabial flaps **17.0%**. The overall complication rate was **11.6%**, with poor wound healing being the most frequently reported complication. Importantly, defects larger than 2 cm², active smoking, and age greater than 75 years were associated with increased complication risk (Halani et al., 2021).

These findings reinforce one of the central elements illustrated by Figure 1: **increasing defect complexity does not simply correspond to increasing defect diameter**. A defect may be relatively limited in surface area yet become highly complex when it involves structural support, free margins, multiple aesthetic subunits, or functionally critical tissues. Conversely, some broader superficial defects can be reconstructed successfully using grafting or local tissue rearrangement. The reconstructive decision must therefore integrate both quantitative characteristics, such as size and depth, and qualitative characteristics, such as anatomical location and functional consequences.

The lip provides another example in which tissue composition substantially influences surgical decision-making. Sanniec et al. (2020) analyzed **615 consecutive lip reconstructions** after Mohs cancer excision. Approximately **40% of defects involved both skin and vermilion**, illustrating the frequency with which resections cross distinct tissue planes. A substantial proportion could nevertheless be managed using linear closure or V-wedge excision and closure, while the reported overall complication rate was **10.2%**. The study emphasizes that reconstructive complexity should be minimized whenever functional and aesthetic objectives can still be reliably achieved, especially because the lips must preserve oral competence, articulation, swallowing and facial expression (Sanniec et al., 2020). (

At the highest level represented in the figure, **extensive composite or multilayer defects** may exceed the capacity of adjacent facial tissues. These cases can require complex staged flaps or microvascular free-tissue transfer, especially when reconstruction must replace several tissue types or substantial three-dimensional volume. Such techniques allow transfer of vascularized skin, fascia, muscle or bone according to the specific defect. Their greater technical complexity is justified when simpler approaches cannot reliably restore functional anatomy or sufficient tissue volume. Nevertheless, increasing reconstructive complexity also entails greater operative demands, donor-site considerations, postoperative monitoring and potential morbidity, making careful patient selection essential.

A crucial principle emerging from the available evidence is therefore to select the **least complex reconstructive procedure capable of reliably achieving the required functional and aesthetic result**, rather than assuming that a more technically complex reconstruction necessarily produces a superior outcome. The evidence-based guideline on reconstruction after skin cancer resection emphasizes the heterogeneity of defects, patients and available procedures and notes that the available literature does not support a universally superior closure technique across facial subsites (Chen et al., 2021). Similarly, contemporary reviews highlight the limited availability of robust comparative evidence between techniques because studies differ substantially in anatomical location, defect size and outcome measurement (Desisto et al., 2023).

Accordingly, Figure 1 supports an **individualized reconstructive paradigm**. Small superficial defects tend to permit simple closure strategies; increasing involvement of facial subunits favors grafts or local flaps; deeper loss of structural

tissues may require regional flaps, grafting or staged reconstruction; and extensive composite defects may justify microvascular reconstruction. However, movement between these categories should always be determined by the functional requirements of the anatomical region and by the characteristics of the individual patient.

Figure 2.

Comparative functional requirements and reconstructive priorities according to facial anatomical region.

Region	Primary functional priority	Main aesthetic priority	Typical reconstructive approach
Nose	Airway patency + structural support	Subunit contour + symmetry	Local flap / graft / forehead flap
Eyelids	Ocular protection + eyelid closure	Margin position + symmetry	Local flap / graft / lamellar reconstruction
Lips / perioral	Oral competence + speech / feeding	Vermilion / commissure alignment	Primary repair / local flap / regional flap
Cheek / forehead	Facial mobility + contour preservation	Texture / scar placement + contour	Local advancement / rotation flap
Composite defects	Multifunctional restoration + tissue replacement	Three-dimensional facial integration	Regional or free flap / multilayer reconstruction

Figure 2 demonstrates that reconstructive planning after cutaneous oncologic resection must be adapted to the **specific anatomical and functional requirements of each facial region**. Although all facial reconstructions pursue adequate tissue coverage and acceptable wound healing, the clinical definition of success differs considerably among the nose, eyelids, lips, cheeks, forehead, and composite facial defects. Consequently, anatomical location represents one of the most important determinants of reconstructive strategy, sometimes even more relevant than the absolute dimensions of the defect (Chen et al., 2021; Desisto et al., 2023).

In **nasal reconstruction**, preservation of airway patency and restoration of structural support constitute major functional priorities. Defects involving only superficial skin may be reconstructed using grafts or local flaps, but deeper resections involving cartilage or internal lining require a multilayer approach. Failure to restore structural support can result in alar retraction, nasal valve collapse, contour irregularity, or respiratory obstruction. From an aesthetic perspective, reconstruction should respect nasal subunits and reproduce appropriate contour, symmetry, skin characteristics, and projection. Losco et al. (2020) emphasize that reconstructive selection should be adapted to defect size and the aesthetic subunit affected, while large clinical experiences demonstrate the usefulness of local flaps, skin grafts, nasolabial flaps, and staged forehead flaps according to defect complexity (Halani et al., 2021; Sanniec et al., 2017).

This relationship between structure and appearance is particularly evident in the nose because an apparently minor aesthetic deformity may simultaneously produce a functional consequence. Alteration of the nasal ala, for example, may affect both facial symmetry and airflow. Therefore, aesthetic and functional goals should not be considered independent outcomes. Recent analyses of post-Mohs nasal reconstruction have increasingly incorporated both domains when evaluating postoperative results, reinforcing the need for a multidimensional assessment rather than focusing exclusively on wound closure or flap viability (Alexander et al., 2025; Wang et al., 2025).

The **periocular region** presents a different reconstructive priority. Here, ocular protection and preservation of eyelid closure are fundamental because inadequate reconstruction may expose the cornea and alter lacrimal distribution. Malposition of the eyelid can lead to ectropion, entropion, lagophthalmos, excessive tearing, irritation, or exposure-related ocular complications. For this reason, periocular reconstruction must restore not only cutaneous coverage but also appropriate lamellar structure, eyelid margin alignment, canthal stability, and dynamic eyelid function (Patel & Itani, 2018).

Aesthetically, even small periocular asymmetries can become conspicuous because the eyelids are positioned around a highly visible and mobile facial structure. Appropriate reconstruction must therefore preserve the natural curvature and position of the eyelid margin while minimizing vertical tension that could produce retraction. Systematic evidence

concerning periocular reconstruction after Mohs surgery demonstrates the variety of local flaps, grafts, and combined techniques available and underscores that procedure selection must depend on defect location, depth, and involvement of anterior or posterior eyelid lamellae (Archibald et al., 2023).

In the **lip and perioral region**, reconstruction must primarily preserve oral competence. The orbicularis oris functions as a dynamic sphincter, and interruption of muscular continuity can affect speech, mastication, swallowing, facial expression, and the ability to retain liquids and food within the oral cavity. Reconstructive planning therefore requires evaluation of the percentage of lip involved, depth of the defect, vermilion involvement, muscular loss, and extension toward the oral commissure. In their large experience with post-Mohs lip reconstruction, Sanniec et al. (2020) demonstrated that different reconstructive solutions can be successfully applied according to defect characteristics while maintaining functional and aesthetic objectives.

The aesthetic priority of lip reconstruction centers on restoration of the **vermilion border, oral commissure, symmetry, and natural lip proportions**. Small errors in alignment can remain highly visible because the vermilion-cutaneous junction constitutes a well-defined facial landmark. At the same time, excessive tightening may produce microstomia or altered oral mobility. Consequently, an aesthetically acceptable lip reconstruction cannot be separated from its functional performance. Preservation of mobility and oral competence must guide the reconstruction even when scar concealment and symmetry are also desired.

Reconstruction of the **cheek and forehead** involves different considerations. These areas generally provide greater tissue availability than the nose, eyelids, or lips, making advancement and rotation flaps especially useful. Nevertheless, their reconstruction must preserve facial contour and avoid displacement of adjacent structures. A cheek flap placed under excessive tension may distort the lower eyelid, nasal ala, or oral commissure. Similarly, forehead reconstruction must account for brow position, hairline relationships, and natural horizontal lines. Johnson et al. (2019) emphasize that reconstruction of the cheek, forehead, and perioral region requires detailed understanding of local anatomy, tissue mobility, and scar positioning to minimize secondary deformity.

A major aesthetic objective in these broader facial regions is to achieve appropriate **color and texture matching while positioning scars within natural facial creases or boundaries whenever possible**. Local flaps frequently offer an advantage because they recruit tissue from nearby areas with similar characteristics. However, the larger the flap, the more important it becomes to anticipate tension vectors and secondary movement of surrounding structures. Combined local flaps may be useful in selected complex defects when a single flap would generate excessive tension or inadequate contour restoration (Taibo & Cabrera-Sarmiento, 2025).

The final category in Figure 2 corresponds to **composite facial and orofacial defects**, where several tissues or functional structures are simultaneously affected. These defects may include skin, subcutaneous tissue, muscle, cartilage, mucosa, or bone and therefore require reconstruction in three dimensions. Regional flaps, staged procedures, or microvascular free-tissue transfer may be necessary when local tissues cannot provide sufficient volume, structural support, or lining. In these circumstances, reconstruction is directed toward multifunctional restoration rather than isolated wound coverage.

The complexity of composite defects also means that postoperative success should be evaluated beyond flap survival. Speech, swallowing, oral separation, facial movement, contour, symmetry, and psychosocial recovery may all contribute to quality of life. Systematic evaluation of patients undergoing head and neck oncologic surgery with free-flap reconstruction has demonstrated that long-term quality of life is influenced by multiple functional and psychosocial dimensions, supporting the incorporation of patient-centered outcomes into reconstructive assessment (Gosselin et al., 2024).

Across all anatomical regions represented in the figure, an important common principle emerges: **the reconstructive technique should be selected according to the function that is at risk**. In nasal defects, airway and support become central; in eyelid defects, protection of the globe and eyelid closure predominate; in lip reconstruction, oral competence and mobility are essential; in cheek and forehead defects, contour and preservation of neighboring structures assume greater importance; and in composite defects, several functional systems must be restored simultaneously.

At the same time, aesthetic restoration should not be interpreted as a secondary or purely cosmetic consideration. Facial appearance influences patient identity, social interaction, confidence, and postoperative satisfaction. Studies examining perception of facial defects have shown that visible facial abnormalities can affect how individuals are perceived by others and that reconstruction may reduce these negative social effects (Dey, Ishii, Byrne, et al., 2015; Dey, Ishii, Boahene, et al., 2015). Therefore, restoration of symmetry, contour, anatomical landmarks, and tissue characteristics has implications that extend beyond physical appearance.

The integration of these dimensions reinforces the need for patient-reported outcome assessment. The FACE-Q Skin Cancer Module provides a mechanism for evaluating satisfaction with appearance, scars, and psychosocial outcomes after facial skin cancer surgery (Lee et al., 2018). Its application is particularly relevant because an anatomically successful reconstruction may not necessarily correspond to high patient satisfaction. Patient expectations, perception of facial change, and ability to resume social activities may significantly influence the final evaluation of treatment (Blank et al., 2020; Dobbs et al., 2021).

Figure 3.

Comparative performance of reconstructive strategies regarding functional preservation, aesthetic integration, and tissue compatibility.

Reconstructive strategy	Functional preservation	Aesthetic integration	Tissue compatibility	Best suited for
Primary closure	High in selected small defects	High when tension is minimal	Very high	Small superficial defects
Skin graft	Moderate	Moderate	Moderate	Superficial defects with adequate bed
Local flap	High	High	Very high	Small-moderate facial subunit defects
Regional / staged flap	High	High	High	Large / deep regional defects
Microvascular free flap	High in complex defects	Moderate-high	Variable by donor site	Extensive composite multilayer defects

Figure 3 presents a qualitative comparison of the principal reconstructive strategies used after facial and orofacial cutaneous oncologic resection according to three clinically relevant dimensions: **functional preservation, aesthetic integration, and tissue compatibility**. The categories shown should not be interpreted as absolute rankings or numerical effectiveness scores. Rather, they synthesize patterns repeatedly described in reconstructive literature, in which the performance of each technique depends strongly on defect size, anatomical location, depth, tissue composition, functional requirements, and patient-related characteristics (Chen et al., 2021; Desisto et al., 2023).

Primary closure represents the simplest reconstructive strategy and can provide excellent functional and aesthetic outcomes when applied to appropriately selected small defects. Its main advantage is that it uses immediately adjacent tissue without introducing a donor site or additional reconstructive interface. Tissue compatibility is therefore inherently high because the wound margins originate from the same anatomical region. When closure can be performed without excessive tension or distortion of surrounding structures, scar formation may also be relatively predictable and can frequently be oriented along relaxed skin tension lines or natural facial creases.

However, the effectiveness of primary closure is highly dependent on defect location. A defect that appears small in absolute dimensions may be unsuitable for direct closure if approximation of its edges causes displacement of the eyelid, nasal ala, vermilion border, or oral commissure. Thus, the favorable functional and aesthetic performance

assigned to primary closure in Figure 3 applies specifically to **well-selected superficial defects with adequate tissue mobility**. Current evidence-based recommendations emphasize that reconstruction should be chosen according to anatomical and defect-specific factors rather than merely according to the apparent simplicity of the surgical wound (Chen et al., 2021).

Skin grafting occupies an intermediate position in the qualitative comparison. It is particularly useful when the defect is superficial and the recipient bed has adequate vascularity, allowing coverage without extensive mobilization of surrounding tissues. This can be advantageous in patients for whom a shorter or less complex reconstructive procedure is desirable. Grafts may also facilitate postoperative surveillance because the reconstructed surface is relatively thin compared with some flap reconstructions.

Nevertheless, aesthetic integration can be less predictable than with local tissue transfer. Differences in pigmentation, thickness, texture, contraction, contour, and sebaceous characteristics may become visible during healing, particularly in highly exposed facial regions. A graft may successfully cover a defect while producing a depression or color mismatch relative to adjacent skin. These considerations explain why grafting is classified as having moderate aesthetic integration and tissue compatibility in the figure. The limitation does not imply poor performance in every patient; rather, it illustrates that donor-site selection and anatomical location have a major influence on the final result (Chen et al., 2021; Egeler et al., 2019).

Clinical experience after Mohs surgery confirms that grafting remains an important component of facial reconstruction. Egeler et al. (2019), in a cohort of 418 patients undergoing head and neck reconstruction after Mohs surgery, reported the use of grafts in approximately one quarter of cases. This demonstrates that grafting continues to represent a practical option within contemporary reconstructive algorithms, particularly when local tissue movement would generate excessive tension or distortion.

Among the techniques compared, **local flaps** demonstrate one of the strongest combinations of functional preservation, aesthetic integration, and tissue compatibility in appropriately selected small-to-moderate defects. Their principal advantage is the transfer of adjacent skin and subcutaneous tissue that closely resembles the recipient site in color, thickness, texture, vascular characteristics, and sun exposure. Local flaps can also redistribute wound tension and reposition scars along facial aesthetic boundaries, potentially improving integration into surrounding tissues (Johnson et al., 2019).

Their usefulness is particularly evident in facial reconstruction because the face contains multiple aesthetic subunits with specific contours and transitions. Advancement, rotation, transposition, bilobed, nasolabial, and other local flap designs allow tissue to be recruited while attempting to preserve these anatomical relationships. However, the same tissue movement that makes local flaps effective can generate secondary deformities if tension vectors are incorrectly planned. Ectropion, alar elevation, commissural distortion, eyebrow displacement, or flattening of normal contour may occur if flap design does not respect local anatomy.

Consequently, the high performance attributed to local flaps in Figure 3 should be understood as conditional upon **appropriate flap selection and surgical design**. Johnson et al. (2019) emphasized the importance of anatomical analysis when reconstructing cheek, forehead, and perioral defects following Mohs surgery. Similarly, contemporary reconstructive approaches increasingly use combinations of local flaps when a single flap cannot adequately distribute tension or restore the three-dimensional characteristics of a defect (Taibo & Cabrera-Sarmiento, 2025).

The advantages of local tissue are particularly relevant in nasal reconstruction. The nose contains convex and concave surfaces, relatively limited tissue mobility, and multiple aesthetic subunits. Reconstruction must frequently preserve nasal contour while preventing distortion of the alar rim and nasal valve. Halani et al. (2021), analyzing a large series of nasal reconstructions after Mohs excision, demonstrated the broad use of several techniques according to the characteristics of the defect, including full-thickness skin grafts, forehead flaps, and nasolabial flaps. These findings reinforce the concept that reconstructive success depends on matching the technique to the specific structural requirements of the nasal defect rather than applying one modality universally.

Regional and staged flaps are shown as having high functional and aesthetic potential in larger or deeper defects. These techniques become particularly valuable when local tissue is insufficient or when reconstruction requires a larger

volume of vascularized tissue. Staged reconstruction may also permit the restoration of multiple layers, including external coverage, structural support, and internal lining.

The paramedian forehead flap represents one of the clearest examples. It remains an important option for substantial nasal defects because forehead skin can provide favorable color and texture characteristics while maintaining reliable vascularity. In a series of 420 consecutive cases, Sanniec et al. (2017) described a standardized approach to forehead flap reconstruction and demonstrated the continued relevance of this technique in complex nasal reconstruction. Its use illustrates how increasing reconstructive complexity may be justified when simpler techniques cannot reproduce the tissue volume, contour, and vascular reliability required for the defect.

The principal disadvantage of staged reconstruction is the additional surgical burden. Multiple procedures, temporary pedicles, longer treatment periods, and additional postoperative care may be required. Therefore, a technique that provides superior tissue characteristics may not be appropriate for every patient. Age, comorbidities, patient preferences, ability to tolerate staged procedures, and anticipated oncologic treatment must be incorporated into decision-making. This illustrates again why technical sophistication alone cannot define reconstructive superiority.

Figure 3 also includes **microvascular free-tissue transfer**, which becomes especially relevant for extensive composite defects. Its principal advantage is the ability to transfer substantial quantities of vascularized tissue and, when necessary, reconstruct different tissue components such as skin, fascia, muscle, or bone. This capacity is particularly important when oncologic resection creates a defect that cannot be adequately restored using adjacent or regional tissues.

Functionally, free-flap reconstruction can be highly effective because it allows restoration of complex three-dimensional anatomy and may facilitate recovery of oral separation, swallowing, speech, mandibular continuity, or substantial soft-tissue volume in selected head and neck defects. Nevertheless, its aesthetic compatibility is more variable because tissue obtained from a distant donor site may differ from native facial skin in thickness, pigmentation, hair distribution, texture, or contour. Secondary refinement procedures may therefore be required in some cases.

The literature on complex head and neck reconstruction further demonstrates that **flap survival alone is an insufficient measure of success**. Gosselin et al. (2024), in a systematic review of quality of life following head and neck cancer surgery and free-flap reconstruction, emphasized the importance of long-term functional and psychosocial outcomes. This principle is applicable to extensive facial and orofacial cutaneous defects: a technically viable flap does not necessarily indicate complete patient recovery if major difficulties with appearance, oral function, speech, or social reintegration persist.

An additional finding illustrated by Figure 3 is that **tissue compatibility decreases as the reconstructive donor site becomes anatomically more distant from the defect**. Primary closure inherently provides native adjacent tissue, while local flaps frequently produce the closest match in facial skin characteristics. Regional flaps can remain highly compatible but may introduce differences in thickness or contour. Free flaps provide essential tissue volume for extensive defects, although their characteristics depend on the selected donor site.

This pattern has important aesthetic implications. Facial reconstruction is highly sensitive to differences in tissue thickness, pigmentation, texture, and contour because even subtle abnormalities may become visible in daily social interaction. However, tissue matching must always be considered in relation to functional requirements. A reconstruction with excellent color match that fails to maintain nasal airway patency or oral competence cannot be considered superior to a slightly less aesthetic reconstruction that successfully preserves essential function.

Similarly, **functional preservation does not depend solely on reconstructive complexity**. Primary closure can provide excellent function for a small defect, whereas free-tissue transfer may be required to restore function after an extensive defect. Therefore, the progression from primary closure to microvascular reconstruction should not be interpreted as an increase in procedural quality but as an increase in the resources required to address more complex tissue loss.

This distinction is fundamental to the interpretation of the results. A reconstructive procedure should be evaluated according to whether it is proportionate to the defect and capable of achieving the required outcome. The principle of

the reconstructive ladder remains clinically useful, but contemporary facial reconstruction frequently adopts a more flexible concept in which the surgeon selects the technique most appropriate for the defect rather than mechanically progressing from the simplest to the most complex option.

The relationship between functional and aesthetic outcomes is particularly apparent in regions such as the lips. Sanniec et al. (2020), in a series of 615 post-Mohs lip reconstructions, demonstrated the wide range of reconstructive strategies required according to defect characteristics. Restoration of the lip cannot be evaluated exclusively through scar appearance because preservation of oral competence, vermilion alignment, muscular continuity, and commissural position has direct consequences for eating, speaking, and facial expression.

The same principle applies to periocular reconstruction. Local flaps and grafts may both be appropriate, but their selection must minimize the risk of eyelid malposition. Archibald et al. (2023) highlighted the diversity of techniques used for periocular defects following Mohs surgery and excision. In this anatomical region, functional preservation requires stable eyelid closure and ocular protection, meaning that even an aesthetically acceptable reconstruction would be considered incomplete if it produces ectropion, lagophthalmos, or other functional abnormalities.

An important extension of Figure 3 is that reconstructive outcomes should ultimately incorporate **the patient's perception of the result**. Technical evaluations by surgeons provide valuable information regarding symmetry, contour, scar appearance, and function, but they do not fully represent psychological or social recovery. The FACE-Q Skin Cancer Module was specifically developed to measure patient-reported outcomes following facial skin cancer surgery and allows evaluation of dimensions such as satisfaction with appearance and postoperative experience (Lee et al., 2018).

Dobbs et al. (2021) further supported the applicability of this instrument in reconstructive populations, while Blank et al. (2020) demonstrated that patient expectations can influence postoperative facial satisfaction. These findings indicate that reconstructive success depends not only on the physical characteristics of the flap, graft, or closure but also on whether the postoperative outcome is consistent with the patient's expectations and functional priorities.

Taken together, the qualitative comparison shown in Figure 3 supports three main findings. First, **primary closure and local flaps can achieve excellent results when defect complexity permits their use**. Second, increasing defect depth and tissue loss require more sophisticated techniques not because complexity itself is beneficial, but because additional tissue, structural support, or functional restoration becomes necessary. Third, no reconstructive strategy can be judged through aesthetics or technical survival alone; function, tissue integration, complications, patient satisfaction, and quality of life must be considered simultaneously.

Figure 4.

Principal postoperative complications and factors influencing reconstructive outcomes.

Complication domain	Representative problems	Major influencing factors	Potential consequence
Wound healing	Dehiscence, delayed healing, scar widening	Tension, vascularity, comorbidities, smoking	Delayed recovery
Tissue viability	Partial flap necrosis, graft loss	Perfusion, flap design, defect depth	Reconstructive failure
Infection / bleeding	Infection, hematoma, seroma	Hemostasis, wound environment, patient risk profile	Morbidity / delayed healing
Anatomic distortion	Ectropion, alar retraction, commissure displacement	Poor vector planning, free-margin involvement	Visible deformity
Functional impairment	Airway obstruction, poor eyelid closure, oral incompetence	Loss of specialized tissue, insufficient structural support	Loss of regional function
Revision burden	Scar revision, flap debulking, secondary contour correction	Complexity, contour mismatch, patient expectations	Additional procedures

Figure 4 summarizes the principal complications that may occur after facial and orofacial reconstruction following cutaneous oncologic resection and illustrates the factors capable of modifying postoperative outcomes. The findings indicate that complications should not be considered exclusively as acute surgical events. In facial reconstruction, an adverse outcome may involve **wound healing, tissue viability, infection or bleeding, anatomical distortion, functional impairment, or the need for secondary corrective procedures**. These categories frequently overlap, meaning that an initially limited complication may subsequently influence aesthetic appearance, regional function, and patient quality of life (Chen et al., 2021; Desisto et al., 2023).

The first domain involves **wound-healing complications**, including dehiscence, delayed epithelialization, scar widening, wound-edge separation, and prolonged inflammatory changes. These problems may occur after any reconstructive technique, although their probability is modified by local vascularity, wound tension, defect location, patient comorbidities, tobacco exposure, and the complexity of tissue transfer. Excessive tension is particularly relevant in facial reconstruction because it can compromise perfusion while simultaneously displacing nearby anatomical structures. Consequently, a wound may technically close but still produce an unfavorable functional or aesthetic result if tension has not been adequately distributed.

Clinical series demonstrate that complication rates vary considerably according to case complexity and reconstructive technique. Egeler et al. (2019), analyzing reconstruction after Mohs surgery in the head and neck, reported a relatively low overall complication rate in their cohort, approximately 3%, while a subset of patients subsequently required scar revision. In contrast, Halani et al. (2021) reported an overall complication rate of approximately 11.6% in a large series of nasal reconstructions. These values should not be interpreted as direct evidence that one population or technique is superior to another because defect size, anatomical location, patient characteristics, and reconstructive complexity differed between studies. Instead, they demonstrate the heterogeneity of postoperative risk in facial reconstruction.

Halani et al. (2021) also identified clinically relevant factors associated with an increased risk of complications in nasal reconstruction, including **larger defects, active smoking, and advanced age**. These observations reinforce the importance of considering patient characteristics in addition to surgical anatomy. Smoking can compromise tissue oxygenation and microvascular perfusion, while advanced age may coexist with vascular disease, reduced tissue elasticity, frailty, or multiple comorbidities. Consequently, reconstructive planning should include evaluation of both the defect and the patient's capacity for adequate wound healing.

The second domain represented in Figure 4 is **tissue viability**. Partial flap necrosis, complete flap loss, or partial skin-graft failure represent clinically important complications because they can expose deeper structures and necessitate prolonged wound care or additional surgery. Vascular supply is fundamental to flap viability, and complications may result from excessive tension, pedicle compression, inappropriate flap dimensions, hematoma formation, venous congestion, or inadequate recipient-bed vascularity.

The impact of tissue loss is particularly significant in anatomically specialized regions. Partial necrosis at the nasal ala may lead to retraction and compromise the nasal valve; tissue loss at the eyelid can alter closure and expose the ocular surface; and necrosis in the lip may result in disruption of oral competence or vermilion alignment. Thus, apparently localized tissue viability complications can produce disproportionate functional consequences.

Skin-graft failure represents a related problem. Successful graft incorporation requires appropriate contact between the graft and recipient bed, sufficient vascularity, absence of significant hematoma or seroma, and adequate immobilization. Even when graft survival is achieved, secondary contraction may modify contour or produce distortion in free-margin regions. This is one reason why grafting must be selected carefully when reconstructing areas such as the nasal ala, eyelid, or lip.

The third complication group comprises **infection, hematoma, and other wound-related morbidity**. Although facial tissues generally possess favorable vascularity, infection remains relevant because it can delay healing, compromise graft or flap survival, and worsen scar formation. Hematoma is particularly important in flap surgery because blood accumulation beneath transferred tissue can interfere with vascular contact, increase pressure, and contribute to ischemia or wound separation. Effective hemostasis and careful postoperative surveillance are therefore essential components of reconstructive management.

The consequences of these complications extend beyond their immediate biological effects. Delayed wound healing can prolong visible facial deformity, increase the frequency of clinical visits, postpone return to normal social activities, and create uncertainty regarding the final appearance. Because facial reconstruction occurs in a highly visible anatomical area, even temporary complications may affect emotional well-being and patient satisfaction.

A particularly important category shown in Figure 4 is **anatomical distortion**. Unlike infection or necrosis, anatomical distortion may occur despite complete wound healing. Examples include ectropion, eyelid retraction, nasal alar elevation, contour collapse, eyebrow displacement, oral commissure deviation, or asymmetry of the vermilion border. Such outcomes are usually related to excessive tension, scar contraction, inadequate structural support, or poorly oriented tissue-transfer vectors.

Periocular reconstruction illustrates this issue clearly. A reconstruction may survive completely but still be unsuccessful if it produces lower eyelid ectropion or inadequate eyelid closure. Patel and Itani (2018) emphasized that eyelid reconstruction requires restoration of stable anatomical relationships and adequate lamellar support. Similarly, Archibald et al. (2023) demonstrated that periocular reconstructive techniques must be selected according to defect location and tissue involvement because inappropriate reconstruction may alter eyelid position and function.

The same principle applies to the nose. Loss of cartilage support or excessive contraction may result in **alar retraction or nasal valve compromise**, producing both visible asymmetry and airway dysfunction. Contemporary nasal reconstruction therefore places considerable emphasis on restoring structural support in addition to replacing skin (Losco et al., 2020; Halani et al., 2021).

Anatomical distortion in the lip can similarly become both a cosmetic and functional complication. Displacement of the commissure or disruption of orbicularis oris continuity may lead to asymmetry, oral incompetence, drooling, impaired articulation, or difficulty eating. In their series of 615 lip reconstructions following Mohs surgery, Sanniec et al. (2020) reported an overall complication rate of approximately 10.2%, underscoring that even well-established reconstructive procedures require careful planning and postoperative assessment.

This leads to another key domain identified in Figure 4: **functional impairment**. These complications are especially important because they directly affect the patient's ability to perform essential activities. Nasal obstruction can impair breathing; inadequate eyelid closure can threaten the ocular surface; oral incompetence can interfere with nutrition and communication; and restriction of facial movement can alter expression and social interaction.

Functional impairment may result directly from tumor resection or secondarily from reconstruction. Therefore, postoperative assessment should distinguish between functional deficits produced by the oncologic defect itself and those potentially introduced or inadequately corrected by reconstruction. The principal objective of reconstruction is

not necessarily to return every anatomical parameter to its preoperative state, which may be impossible after extensive tissue loss, but to obtain the **maximum functional preservation or restoration compatible with oncologic safety**.

The figure also emphasizes the importance of **structural support**. In specialized facial regions, soft-tissue coverage alone may be insufficient. Cartilage grafting may be necessary to maintain nasal contour and airway patency, while eyelid defects may require reconstruction of both anterior and posterior lamellae. Similarly, lip defects involving muscle may require restoration of muscular continuity rather than simple cutaneous closure. Failure to reconstruct these deeper components can lead to delayed functional complications even when early wound healing appears satisfactory.

Another major outcome is the **burden of secondary revision procedures**. Scar revision, flap debulking, contour correction, commissuroplasty, graft refinement, or other secondary procedures may be required after the initial reconstruction. Revision should not always be interpreted as failure because staged refinement is an expected component of some reconstructive strategies. For example, complex nasal reconstruction using a forehead flap may intentionally involve multiple operations (Sanniec et al., 2017).

However, unplanned revision represents a clinically relevant outcome because it increases treatment burden, costs, operative exposure, and recovery time. It may also affect the patient's perception of reconstructive success. Therefore, postoperative studies should distinguish between planned multistage reconstruction and unexpected secondary surgery required to correct complications or unsatisfactory outcomes.

Patient expectations are particularly relevant in this context. Blank et al. (2020) demonstrated that expectations can influence postoperative facial satisfaction. A technically acceptable scar or minor contour irregularity may be perceived differently depending on preoperative counseling and the patient's expectations regarding the final appearance. Consequently, communication before surgery should include discussion of potential asymmetry, scars, staged procedures, healing time, and the possibility of secondary refinement.

The relationship between complications and **quality of life** represents another central finding. Traditional surgical outcomes focus on infection, necrosis, wound dehiscence, and flap survival; however, these measures do not adequately capture psychological and social recovery. Lee et al. (2018) developed the FACE-Q Skin Cancer Module specifically to evaluate patient-reported outcomes after facial skin cancer surgery, including satisfaction with appearance and scars. Dobbs et al. (2021) subsequently supported its use as a structured tool for evaluating reconstructive populations.

These patient-reported measures are particularly valuable when complications do not produce obvious technical failure. A reconstruction may heal without necrosis or infection yet leave the patient dissatisfied because of conspicuous scarring, altered facial identity, persistent functional limitation, or social self-consciousness. Conversely, a patient may experience a minor postoperative complication but ultimately report high satisfaction after adequate healing and functional restoration. This demonstrates why complication rates alone cannot define reconstructive success.

The comparison among published series also illustrates that **raw complication percentages must be interpreted cautiously**. A low complication rate in a population with predominantly small defects cannot be directly compared with a higher rate in patients requiring complex nasal, composite, or microvascular reconstruction. Case complexity, surgical technique, follow-up duration, definition of complications, and patient characteristics substantially influence reported outcomes (Desisto et al., 2023).

Therefore, complication assessment should ideally include not only frequency but also **severity and clinical consequence**. A minor superficial wound separation managed conservatively differs considerably from flap loss requiring reoperation, and both differ from a persistent functional deficit such as ectropion or oral incompetence. Future evaluations of reconstructive performance should therefore classify adverse events according to their impact on healing, function, appearance, requirement for additional treatment, and quality of life.

Figure 5.

Integration of functional, aesthetic, and patient-reported quality-of-life outcomes as indicators of overall reconstructive success.

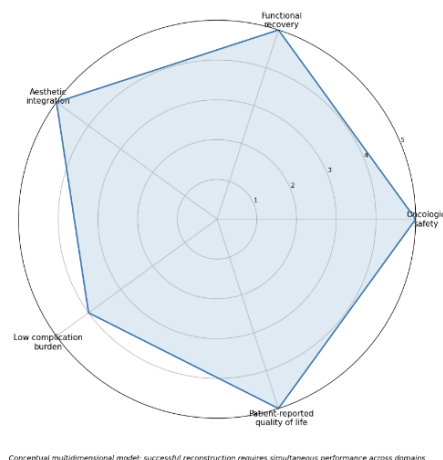


Figure 5 integrates the principal outcome domains identified throughout the reviewed literature and illustrates that **overall reconstructive success after facial and orofacial cutaneous oncologic resection is inherently multidimensional**. Rather than depending on a single surgical endpoint, successful reconstruction results from the interaction of oncologic safety, functional recovery, aesthetic integration, a low complication burden, and patient-reported quality of life. These domains should be evaluated simultaneously because an apparently favorable result in one dimension may coexist with important deficiencies in another (Chen et al., 2021; Desisto et al., 2023).

The first component is **oncologic safety**, which remains the fundamental condition upon which all subsequent reconstructive objectives depend. Reconstruction cannot be considered successful if tumor control is compromised. Complete excision with appropriate margin assessment, followed by adequate clinical surveillance, establishes the basis for reconstructive planning. Mohs micrographic surgery is particularly relevant in selected facial skin cancers because it allows detailed margin assessment while preserving uninvolved tissue, an advantage in regions where even small amounts of additional tissue loss can increase reconstructive complexity (Egeler et al., 2019; Chen et al., 2021).

Nevertheless, oncologic safety and reconstruction should not be viewed as opposing priorities. Tissue preservation achieved through precise oncologic surgery can reduce defect dimensions and preserve structures that are important for nasal support, eyelid closure, oral competence, and facial symmetry. Therefore, optimal treatment requires coordination between adequate tumor clearance and preservation of reconstructive options. The central objective is not to reduce the oncologic resection to facilitate reconstruction, but to ensure complete tumor removal while planning the reconstruction according to the resulting anatomical defect.

The second major component is **functional recovery**. Facial structures perform highly specialized and interdependent functions, meaning that reconstructive success must be adapted to the anatomical region involved. Nasal reconstruction should maintain airway patency and structural stability; eyelid reconstruction must preserve ocular protection and effective closure; lip and perioral reconstruction must maintain oral competence, speech, feeding, and facial movement; and complex orofacial reconstruction may require simultaneous restoration of several functional systems (Patel & Itani, 2018; Sanniec et al., 2020; Halani et al., 2021).

Functional preservation is especially important because some postoperative deficits may have persistent effects on daily activities. Nasal valve collapse can produce chronic obstruction, incomplete eyelid closure can threaten the ocular surface, and oral incompetence may affect nutrition and social communication. These consequences demonstrate that successful tissue survival is insufficient if the reconstructed region fails to perform its essential physiological function.

The importance of function is also closely associated with reconstructive depth. Superficial skin-only defects may allow relatively simple approaches, whereas loss of cartilage, muscle, mucosa, or bone often requires restoration of structural or dynamic components. In nasal reconstruction, for instance, adequate skin coverage without cartilage

support may result in delayed collapse or retraction. Similarly, reconstruction of a lip defect without restoring muscular continuity may produce a visually acceptable closure but inadequate oral competence. The reviewed evidence therefore supports evaluation of functional outcomes as a primary endpoint rather than as a secondary consideration (Losco et al., 2020; Sanniec et al., 2020).

The third component is **aesthetic integration**. The face occupies a unique position in reconstructive surgery because appearance is intrinsically related to personal identity, interpersonal communication, and social perception. Aesthetic restoration should therefore not be interpreted as superficial or optional. Instead, it constitutes an important component of patient recovery and can influence psychosocial adaptation after cancer treatment.

Aesthetic integration includes preservation or recreation of facial symmetry, contour, anatomical landmarks, scar positioning, color and texture compatibility, and relationships among facial aesthetic subunits. Local flaps frequently offer advantages because they transfer adjacent tissue with characteristics similar to those of the defect, while skin grafts and distant free-tissue transfer may present greater differences in texture, thickness, or pigmentation depending on the donor site (Johnson et al., 2019; Desisto et al., 2023).

The nose provides a particularly important example of the aesthetic subunit principle. Reconstruction must consider the natural boundaries and three-dimensional contours of the dorsum, tip, sidewalls, alae, and soft triangles. Losco et al. (2020) emphasized the relationship between nasal aesthetic subunits, defect size, and reconstructive selection. Similarly, large clinical series using forehead and nasolabial flaps have demonstrated the importance of reconstructing contour and tissue characteristics in addition to achieving wound closure (Sanniec et al., 2017; Halani et al., 2021).

Aesthetic outcome is equally relevant in the lips and periocular region because very small abnormalities in alignment can be highly visible. Vermilion mismatch, oral commissure displacement, eyelid retraction, or loss of canthal symmetry may significantly influence the patient's perception of the result. These abnormalities can also have functional consequences, reinforcing the concept that function and aesthetics are not independent domains.

The fourth element shown in Figure 5 is a **low complication burden**. The findings described in the previous figure demonstrate that reconstruction should ideally achieve stable healing while minimizing tissue necrosis, graft loss, dehiscence, infection, hematoma, anatomical distortion, and unplanned secondary procedures. Complications may delay recovery and may also directly affect the functional and aesthetic dimensions represented in the model.

For example, partial flap necrosis may alter final contour; excessive scar contraction may cause eyelid or nasal distortion; and infection can delay healing and negatively influence scar quality. Similarly, a reconstruction requiring several unplanned revision procedures can increase treatment burden even if the final anatomical result becomes satisfactory. This indicates that complications should be assessed not only according to their occurrence but also according to their consequences for long-term recovery.

Clinical evidence demonstrates that postoperative risk is not uniform across patients. Halani et al. (2021), in a large series of nasal reconstruction after Mohs excision, identified factors such as active smoking, advanced age, and larger defects as contributors to increased complication risk. These findings support the integration of patient risk profile into reconstructive decision-making and reinforce the importance of tailoring surgical complexity to individual circumstances.

However, low complication rates alone cannot define success. A reconstruction can heal without infection, necrosis, or dehiscence but still produce poor functional or aesthetic outcomes. Conversely, a patient may experience a minor postoperative complication yet ultimately achieve excellent function and high satisfaction. This is why complication burden occupies only one component of the broader model presented in Figure 5.

The fifth and increasingly important component is **patient-reported quality of life**. Traditional surgical assessment has been dominated by clinician-reported outcomes, including flap viability, scar characteristics, symmetry, wound healing, and complication rates. Although these variables remain essential, they do not fully capture the patient's experience of facial reconstruction. Satisfaction with appearance, confidence, social interaction, emotional well-being, perception of scars, and ability to return to normal activities are also important indicators of treatment success.

The FACE-Q Skin Cancer Module was specifically developed to evaluate outcomes following facial skin cancer surgery from the patient's perspective. Lee et al. (2018) demonstrated its usefulness for measuring patient-reported domains relevant to this population. Subsequent work has supported its application in reconstructive settings and reinforced the importance of incorporating standardized patient-reported measures into outcome assessment (Dobbs et al., 2021).

This perspective is especially relevant because **clinician and patient assessments may not always coincide**. A surgeon may consider a reconstruction technically successful based on adequate contour, symmetry, and scar characteristics, while the patient may remain dissatisfied due to altered self-image or social confidence. Conversely, a patient may report high satisfaction despite minor residual asymmetry when the reconstruction preserves function and allows rapid return to normal activities.

Blank et al. (2020) further demonstrated that patient expectations can influence postoperative facial satisfaction. This suggests that quality of life is shaped not only by the physical reconstruction but also by preoperative communication, expectations, understanding of anticipated scars, awareness of possible staged procedures, and the individual's perception of recovery. Shared decision-making therefore becomes an important component of reconstructive quality.

The psychosocial importance of facial appearance is also supported by studies examining how facial defects influence social perception. Dey, Ishii, Byrne, et al. (2015) demonstrated a social penalty associated with visible facial lesions, while Dey, Ishii, Boahene, et al. (2015) showed that reconstructive improvement can modify perceptions of attractiveness and negative facial evaluation. These findings indicate that the consequences of facial reconstruction extend beyond surgical anatomy and influence broader aspects of interpersonal and social functioning.

The interaction among all five domains is the most important finding represented by Figure 5. **Oncologic safety establishes the foundation, function determines physiological recovery, aesthetics influences facial integration and identity, complication burden affects the trajectory of recovery, and patient-reported quality of life reflects the final lived experience of treatment.** None of these components can independently describe the complete outcome.

A patient with excellent tumor clearance but severe oral incompetence cannot be considered to have achieved optimal overall recovery. Similarly, a patient with excellent flap survival but persistent nasal obstruction, ectropion, or major dissatisfaction with appearance represents an incomplete reconstructive success. Conversely, a reconstruction that restores regional function, achieves acceptable facial integration, minimizes postoperative complications, and allows the patient to regain social confidence represents a more comprehensive outcome even when minor residual asymmetry persists.

This multidimensional interpretation is also relevant when comparing reconstructive techniques. A skin graft, local flap, regional flap, or free flap should not be judged only according to technical complexity or aesthetic appearance. The most appropriate procedure is the one that best satisfies the required combination of oncologic, functional, aesthetic, and patient-centered objectives for the specific defect. Therefore, the same technique may represent an optimal choice in one patient and an inadequate choice in another.

The reviewed literature also suggests that more complex reconstruction should not automatically be interpreted as higher-quality reconstruction. Primary closure can provide the best overall result for an appropriately selected small defect, while microvascular transfer may be indispensable for a large composite defect. The relevant issue is **proportionality between defect requirements and reconstructive strategy**, not procedural complexity itself (Chen et al., 2021; Desisto et al., 2023).

In extensive head and neck defects, this principle is particularly evident. Free-tissue transfer may successfully reconstruct major anatomical losses, but long-term evaluation must extend beyond flap survival. Gosselin et al. (2024) emphasized that quality of life following head and neck cancer surgery and free-flap reconstruction remains influenced by functional, psychological, and social outcomes. This reinforces the need to evaluate advanced reconstruction using the same multidimensional model applied to smaller facial defects.

Another important implication of Figure 5 is the need for **standardized outcome assessment**. Heterogeneity among published studies makes direct comparison difficult because some investigations prioritize complications, others focus

on aesthetic evaluation, and others examine patient-reported quality of life. A comprehensive framework incorporating these domains would facilitate more consistent comparison among reconstructive strategies and improve the quality of future evidence (Desisto et al., 2023).

Accordingly, outcome assessment after facial cutaneous oncologic reconstruction should ideally include measures of tumor control, region-specific function, objective and subjective aesthetic outcomes, postoperative complications, need for secondary intervention, and validated patient-reported outcomes. This approach would provide a more accurate representation of treatment effectiveness than any isolated endpoint.

Taken together, the findings represented in Figure 5 support the central hypothesis of this study. **Optimal facial and orofacial reconstruction does not depend on a universally superior surgical technique but on individualized decision-making capable of balancing oncologic safety, functional recovery, aesthetic restoration, complication prevention, and patient quality of life.** The evidence therefore favors a patient-centered reconstructive model in which surgical success is defined not merely by closure of the oncologic defect, but by the degree to which the patient can recover facial function, appearance, identity, and participation in daily life (Chen et al., 2021; Lee et al., 2018; Zimmer et al., 2023).

DISCUSIÓN

The findings of this review reinforce the concept that facial and orofacial reconstruction after cutaneous oncologic resection must be evaluated through a multidimensional framework. Although complete tumor removal remains the primary therapeutic objective, the reconstructive process determines how effectively the patient recovers regional function, facial appearance, psychological well-being, and social participation. The evidence analyzed suggests that no reconstructive technique is universally superior; instead, successful outcomes depend on matching the complexity of the procedure to the anatomical characteristics of the defect and the functional requirements of the affected facial region (Chen et al., 2021; Desisto et al., 2023; Zimmer et al., 2023).

One of the most consistent findings is that **defect complexity cannot be defined solely by surface area.** Depth, tissue composition, proximity to free margins, involvement of specialized structures, and loss of structural support may transform a relatively small defect into a highly demanding reconstructive problem. This observation is particularly relevant in the nose, eyelids, and lips, where millimetric alterations may cause clinically meaningful changes in airway patency, ocular protection, or oral competence. Therefore, reconstructive algorithms based only on defect diameter may be insufficient for clinical decision-making.

The results also support the continued utility of the reconstructive ladder, but with a more flexible interpretation. Primary closure, secondary intention healing, and skin grafting remain appropriate for selected defects, while local flaps, regional flaps, staged techniques, and free-tissue transfer are required as tissue loss becomes more complex. However, the objective should not be to advance automatically toward a technically more sophisticated procedure. Rather, the most appropriate strategy is the **least complex reconstruction capable of providing reliable coverage without compromising function or facial harmony** (Chen et al., 2021).

This principle is reflected in the clinical experience reported by Egeler et al. (2019), in which a substantial proportion of post-Mohs defects of the head and neck could be reconstructed using local advancement flaps or grafts with a relatively low complication rate. These findings indicate that many facial defects can be managed successfully without advanced tissue transfer when anatomical conditions are favorable. Nevertheless, they also emphasize the importance of patient selection, because the same reconstructive technique may generate very different outcomes depending on location, tension, tissue mobility, and depth.

The **nose** represents one of the clearest examples of the relationship between anatomy, function, and aesthetics. The results showed that nasal reconstruction requires consideration of external coverage, structural support, and internal lining. Halani et al. (2021) demonstrated considerable diversity in reconstructive approaches across a large series of nasal defects, including full-thickness skin grafts, forehead flaps, and nasolabial flaps. This variability supports the idea that nasal reconstruction cannot be standardized according to a single technique.

Moreover, the aesthetic subunit principle remains highly relevant in nasal reconstruction. The nose contains distinct convexities and concavities that determine facial contour and light reflection. Reconstruction that ignores these anatomical boundaries may produce visible asymmetry even when wound healing is technically satisfactory. Losco et al. (2020) emphasized the need to select reconstructive strategies according to defect size and nasal aesthetic subunit, reinforcing the importance of anatomical planning.

The role of the **paramedian forehead flap** also illustrates the balance between technical complexity and reconstructive benefit. Although it requires staged procedures, it remains a valuable option for larger or deeper nasal defects because it provides vascularized tissue with favorable characteristics and can support multilayer reconstruction. Sanniec et al. (2017) demonstrated its continued utility in a large consecutive clinical series. However, the need for several operative stages also means that patient age, comorbidities, treatment expectations, and willingness to undergo repeated procedures must be considered.

The **perioral region** presents another major challenge because aesthetic restoration is directly linked to dynamic function. The lips participate in oral competence, articulation, mastication, swallowing, facial expression, and social communication. Consequently, reconstruction must preserve the continuity and mobility of the orbicularis oris whenever possible. Sanniec et al. (2020) demonstrated that post-Mohs lip defects can be reconstructed using different techniques according to size and depth, with the objective of maintaining both oral function and acceptable symmetry.

An important implication is that the aesthetic outcome of lip reconstruction cannot be interpreted independently of function. A well-concealed scar does not represent an optimal result if the patient develops microstomia, drooling, difficulty eating, or commissural displacement. Conversely, slight residual asymmetry may be clinically acceptable when oral competence and mobility are preserved. This observation highlights the need to prioritize **functional significance rather than purely visual perfection**.

A similar relationship exists in **periocular reconstruction**. The eyelids must maintain stable closure, ocular surface protection, tear distribution, and anatomical alignment. Patel and Itani (2018) and Archibald et al. (2023) emphasized the importance of reconstructing eyelid lamellae and preserving appropriate tension and canthal support. These findings demonstrate that a visually acceptable reconstruction may still be clinically inadequate if it produces ectropion, entropion, lagophthalmos, or exposure-related complications.

The results regarding **local flaps** also deserve particular consideration. Local tissue transfer demonstrated several theoretical and practical advantages because adjacent skin frequently provides the closest match in color, thickness, texture, and vascular characteristics. Johnson et al. (2019) highlighted the value of local reconstructive techniques in cheek, forehead, and perioral defects, where appropriate flap design can preserve contour and position scars along natural facial lines.

However, local flaps are not inherently superior in every circumstance. Their effectiveness depends on correct understanding of tension vectors, tissue mobility, vascular supply, and adjacent free margins. A poorly designed local flap may produce more distortion than a well-selected graft. Therefore, technical familiarity and anatomical planning remain essential determinants of success.

The analysis of postoperative complications further supports the importance of individualized planning. Complications such as dehiscence, partial flap necrosis, graft loss, infection, hematoma, scar contraction, and secondary anatomical distortion may alter both short- and long-term outcomes. Halani et al. (2021) identified factors including larger defect size, smoking, and advanced age as relevant predictors of increased postoperative risk in nasal reconstruction.

These findings are clinically important because they demonstrate that reconstructive outcomes are influenced by both surgical technique and patient-related factors. Smoking may impair tissue perfusion, while advanced age and comorbidities may affect wound healing and physiological reserve. Therefore, reconstructive planning should incorporate risk stratification rather than focusing exclusively on the anatomical defect.

Another relevant finding is that **complication rates should not be interpreted without considering case complexity**. A higher complication rate in a series of extensive reconstructions does not necessarily indicate poorer surgical performance than a lower rate observed in smaller superficial defects. Study populations differ substantially in defect

size, anatomical region, reconstructive technique, follow-up duration, and definitions of postoperative complications. This heterogeneity limits direct comparison among published studies and represents one of the principal limitations of the current literature (Desisto et al., 2023).

The findings also suggest that the traditional definition of surgical success based on flap survival is increasingly insufficient. A viable flap can coexist with poor functional recovery, contour mismatch, conspicuous scarring, or patient dissatisfaction. Conversely, minor postoperative complications may resolve without significantly affecting the patient's final functional or psychosocial outcome. Therefore, reconstruction should be evaluated using outcome measures that extend beyond technical survival.

This shift is strongly supported by the development of **patient-reported outcome measures**. The FACE-Q Skin Cancer Module provides a structured instrument for assessing satisfaction with facial appearance, scars, and other patient-centered outcomes after facial skin cancer surgery (Lee et al., 2018). Dobbs et al. (2021) further supported the applicability of this approach in reconstructive populations.

The incorporation of patient-reported outcomes is especially important because surgeon-based assessments may not fully represent the patient's experience. Surgeons typically focus on symmetry, contour, tissue viability, scar quality, and anatomical restoration, whereas patients may prioritize social confidence, recognizability, expression, or the ability to resume normal daily activities. Therefore, the addition of validated patient-reported measures improves the clinical interpretation of reconstructive success.

The influence of **patient expectations** must also be considered. Blank et al. (2020) demonstrated that expectations can affect postoperative satisfaction. This suggests that successful reconstruction begins before surgery through realistic counseling regarding anticipated scars, treatment stages, possible asymmetries, healing time, and the possibility of revision procedures. Shared decision-making can therefore influence both satisfaction and perceived quality of care.

The psychosocial dimension of facial reconstruction is further supported by studies demonstrating that visible facial abnormalities can affect social perception. Dey, Ishii, Byrne, et al. (2015) and Dey, Ishii, Boahene, et al. (2015) showed that facial defects may generate negative social perceptions and that reconstructive improvement can modify these responses. These findings reinforce the concept that aesthetic restoration is not merely cosmetic; it can contribute to identity, self-confidence, interpersonal interaction, and social reintegration.

In more extensive defects, **microvascular free-tissue transfer** expands reconstructive possibilities by providing vascularized soft tissue, muscle, fascia, or bone. Nevertheless, the analysis suggests that these procedures must also be evaluated beyond flap survival. Gosselin et al. (2024) showed that quality of life after head and neck cancer surgery and free-flap reconstruction depends on multiple functional and psychosocial dimensions. These observations are relevant to complex facial and orofacial defects because extensive reconstruction may restore anatomy while still leaving substantial functional or psychological limitations.

The results of this review therefore favor a transition from a **procedure-centered model to a patient-centered reconstructive model**. In a procedure-centered model, success is defined mainly by defect closure, graft take, or flap viability. In contrast, a patient-centered model evaluates whether the reconstruction allows the individual to breathe adequately, protect the ocular surface, maintain oral competence, preserve facial expression, accept the resulting appearance, and return to normal social activity.

This multidimensional model also has implications for multidisciplinary care. Facial oncologic reconstruction may benefit from coordination among dermatologic surgeons, surgical oncologists, plastic surgeons, facial plastic surgeons, ophthalmologists, maxillofacial surgeons, speech and swallowing specialists, and rehabilitation professionals depending on the extent and location of the defect. Complex cases should ideally be planned with consideration of both immediate tissue reconstruction and long-term functional rehabilitation.

The findings additionally highlight a methodological limitation in the current evidence base: **outcome measures remain heterogeneous**. Some studies emphasize complications and revision rates, others focus on aesthetic appearance, and relatively fewer include validated patient-reported outcome measures. Different definitions and

assessment methods reduce comparability between reconstructive techniques and make it difficult to establish universal superiority of one approach over another (Desisto et al., 2023).

Future studies should therefore adopt more standardized outcome frameworks. Ideally, reconstructive research should report oncologic status, defect characteristics, reconstructive technique, complications, region-specific functional outcomes, aesthetic evaluation, need for secondary procedures, and validated patient-reported quality-of-life measures. Such standardization would improve comparison among techniques and facilitate evidence-based reconstructive algorithms.

Another limitation is that many available studies are retrospective case series. Randomized controlled trials are difficult in reconstructive surgery because defects cannot easily be standardized and ethical or anatomical considerations often determine the technique. Nevertheless, prospective multicenter registries and standardized observational studies could provide higher-quality comparative data without requiring random assignment.

Despite these limitations, the available evidence consistently supports the principal hypothesis proposed in this study: **successful reconstruction is determined by individualized integration of defect characteristics, functional priorities, aesthetic requirements, patient risk factors, and expectations rather than by the routine use of a single reconstructive technique.**

The findings also demonstrate that function, aesthetics, and quality of life should not be conceptualized as competing objectives. In facial reconstruction, they are frequently interdependent. Restoring nasal contour can preserve airway function; maintaining eyelid position simultaneously improves appearance and ocular protection; reconstructing the oral commissure contributes to symmetry and oral competence. Therefore, surgical planning should aim for integration rather than prioritizing one domain at the expense of the others.

CONCLUSIÓN

Facial and orofacial reconstruction after cutaneous oncologic resection should be understood as a comprehensive therapeutic process in which oncologic control, functional preservation, aesthetic restoration, and quality of life are inseparable objectives. The findings of this review indicate that reconstructive success does not depend on the use of a single superior technique, but on the individualized selection of the procedure according to defect size, depth, anatomical subunit, tissues involved, functional requirements, patient comorbidities, and expectations.

Primary closure, skin grafts, local flaps, regional or staged flaps, and microvascular free-tissue transfer each have specific indications and limitations. Simpler techniques may provide excellent outcomes in appropriately selected defects, whereas complex multilayer or composite defects require more advanced reconstructive strategies. Therefore, surgical complexity should be proportional to the anatomical and functional demands of the defect rather than pursued as an objective in itself (Chen et al., 2021; Desisto et al., 2023).

The analysis also demonstrates that the definition of success must extend beyond wound healing, graft take, or flap survival. Nasal airway preservation, ocular protection, oral competence, speech, mastication, facial mobility, symmetry, contour, scar quality, and preservation of facial landmarks are essential components of postoperative assessment. In highly specialized regions such as the nose, eyelids, and lips, functional and aesthetic outcomes are closely interdependent.

Patient-centered outcomes represent an equally important dimension. Instruments such as the FACE-Q Skin Cancer Module allow postoperative evaluation to incorporate satisfaction with appearance, scar perception, psychological well-being, and social recovery (Lee et al., 2018). This perspective is particularly relevant because technically satisfactory reconstruction does not always correspond to optimal patient satisfaction or quality of life.

The available evidence therefore supports the study hypothesis that the best reconstructive outcomes arise from a **multidimensional and individualized approach** rather than from the routine application of a specific technique. Oncologic safety should remain the foundation of treatment, but reconstruction should simultaneously seek to minimize complications, preserve regional function, restore facial harmony, and facilitate psychosocial reintegration.

Future research should prioritize prospective studies, standardized reporting of defect characteristics and reconstructive techniques, region-specific functional measures, validated aesthetic assessments, and patient-reported outcomes. Greater methodological consistency would improve comparison among reconstructive strategies and facilitate the development of more precise evidence-based algorithms.

In conclusion, contemporary facial and orofacial reconstruction after cutaneous cancer resection should aim not merely to close an oncologic defect, but to restore the patient as comprehensively as possible. The optimal result is achieved when **oncologic safety, function, aesthetics, and quality of life are balanced within a patient-centered reconstructive plan**, allowing recovery of both facial integrity and meaningful participation in daily and social life.

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