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REVIEW ARTICLE

Tissue necrosis from hyaluronic acid in dentistry: evaluation of maxillofacial complications and management strategies

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ABSTRACT

Introduction: hyaluronic acid is widely used in aesthetic dentistry, but it can cause tissue necrosis, a complication that compromises the safety of maxillofacial procedures.
Objective: to review the scientific literature on necrosis associated with the use of hyaluronic acid in nasal reshaping and glabellar filling, identifying risk factors and management strategies.
Methods: a bibliographic review was conducted between 2019 and 2024 in databases such as PubMed, Scielo, and ScienceDirect. Clinical studies and relevant cases in English, Spanish, and Portuguese were included. Exclusion criteria were applied to non-indexed literature and uses other than aesthetic. The analysis compared injection techniques, complications, and treatments.
Development: the reviewed studies report necrosis mainly in the glabella, nasal tip, and lips, associated with accidental vascular occlusion. Early intervention with hyaluronidase stands out as an essential treatment, complemented by corticosteroids, antibiotics, and hyperbaric oxygen therapy. The importance of anatomical knowledge and the use of blunt-tip cannulas to reduce risks is emphasized. Although the frequency of necrosis is low, its clinical impact is considerable, requiring standardized protocols and continuous training. The literature also shows variability in the recommended doses of hyaluronidase, reflecting the need for further research to establish clear guidelines.
Conclusions: necrosis caused by hyaluronic acid is an infrequent but serious complication in aesthetic dentistry. Prevention through safe techniques and the immediate availability of hyaluronidase are fundamental. Strengthening professional training and developing evidence-based protocols are recommended to optimize the safety of procedures.In conclusion, this review underlines the importance of constant training in HA management in dentistry, highlighting the relevance of an evidence-based approach to increase the safety and effectiveness of buccomaxillofacial esthetic procedures.

Keywords: Hyaluronic Acid; Esthetics, Dental; Necrosis; Patient Safety.

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INTRODUCTION

Discovered in 1934 by Karl Meyer and John Palmer, hyaluronic acid (HA) is a natural polysaccharide found in numerous human tissues, including skin, cartilage, and synovial fluids.[1] Initially used in ophthalmology—particularly as a vitreous humor replacement during cataract surgery,[2]—HA has since been extensively studied due to its viscoelastic, hydrating, and biocompatible properties.[3] Over time, its use has expanded significantly into other medical fields, including dermatology and, more recently, dentistry.[4]

In dentistry, HA has become a cornerstone of orofacial harmonization,[3,5,6] a subspecialty focused on the aesthetic and functional enhancement of perioral and facial tissues. Orofacial harmonization with HA encompasses numerous procedures aimed at improving facial appearance and function, notably rhinomodelling and glabellar filler injections.[7]

Rhinomodelling is a non-surgical technique that uses HA injections to improve nasal shape and contour, correcting asymmetries and achieving a more pleasing aesthetic without surgical intervention.[2] This procedure allows for immediate results with minimal patient discomfort, enabling refinement of the nasal profile, smoothing of the nasal bridge, and elevation of the nasal tip.[7]

Glabellar filler, on the other hand, is used to reduce deep wrinkles and pronounced expression lines between the eyebrows—known as glabellar lines.[1] These lines often convey a constant appearance of anger or concern; their correction with HA yields a more youthful and relaxed look. Both rhinomodelling and glabellar filler have gained popularity due to their efficacy, minimally invasive nature, and rapid recovery.[8]

Despite the benefits of HA in orofacial harmonization, its use carries certain risks. One of the most severe—though infrequent—complications is maxillofacial tissue necrosis.[9] This condition occurs when HA is inadvertently injected into a blood vessel, obstructing blood flow and causing tissue death. Symptoms range from intense pain and skin discoloration to, in severe cases, ulceration and tissue loss.[8,10]

HA-induced necrosis in the maxillofacial region may result from several factors, including injection technique, practitioner expertise, and specific product characteristics. Additionally, the complex vascular anatomy of the treated area increases complication risk. The nasal and glabellar regions feature a dense vascular network that can complicate execution and raise the likelihood of inadvertent intravascular injection.[2,11]

This research is significant for its potential to substantially improve the safety and efficacy of HA-based orofacial harmonization procedures. By enhancing practitioner awareness, it indirectly benefits patients through reduced risk of severe complications and improved aesthetic and functional outcomes. Given this context, the study's objective was to review the scientific literature on HA-associated necrosis in rhinomodelling and glabellar filler, identifying risk factors and management strategies.

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METHODS

Study Design

This work constitutes a systematic bibliographic review following PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The aim was to identify, analyze, and synthesize available scientific evidence on HA-associated tissue necrosis in aesthetic dentistry procedures. The search period spanned from January 2010 to May 2024 to include both recent studies and landmark publications on maxillofacial complications related to HA infiltration.

Information Sources and Search Strategy

The search strategy was implemented in high-impact, scientifically comprehensive databases: PubMed, SciELO, ScienceDirect, Google Scholar, LILACS, and BVSALUD. These platforms were selected for their relevance in disseminating biomedical and dental literature. Secondary references from selected article bibliographies were also reviewed to identify complementary studies missed in the initial search. Gray literature—including technical reports and academic documents from institutional repositories—was considered when meeting quality and thematic relevance criteria.

Searches combined keywords and Boolean operators, adapted per database to maximize relevant retrieval. Terms included: "hyaluronic acid," "tissue necrosis," "orofacial harmonization," "glabellar filler," "nose reshaping," and "complications," combined with AND/OR operators. Sample algorithms: ("hyaluronic acid" AND "tissue necrosis" AND "maxillofacial"), ("glabellar filler" AND "necrosis" AND "case study"), and ("hyaluronic acid" AND "orofacial harmonization" AND "adverse effects"). Publications in Spanish, English, and Portuguese were included, as these languages represent the majority of scientific output in the field.

Selection Process

Study selection occurred in stages. First, titles and abstracts were screened to exclude non-compliant articles. Full-text review followed to assess relevance and methodological quality. The initial search yielded 373 records. After duplicate removal and exclusion criteria application, the sample was reduced to 58 articles. Finally, 22 studies were included in qualitative analysis after full-text evaluation and relevance assessment. The process was illustrated via a PRISMA flow diagram (Figure 1), transparently depicting identification, screening, eligibility, and inclusion phases.

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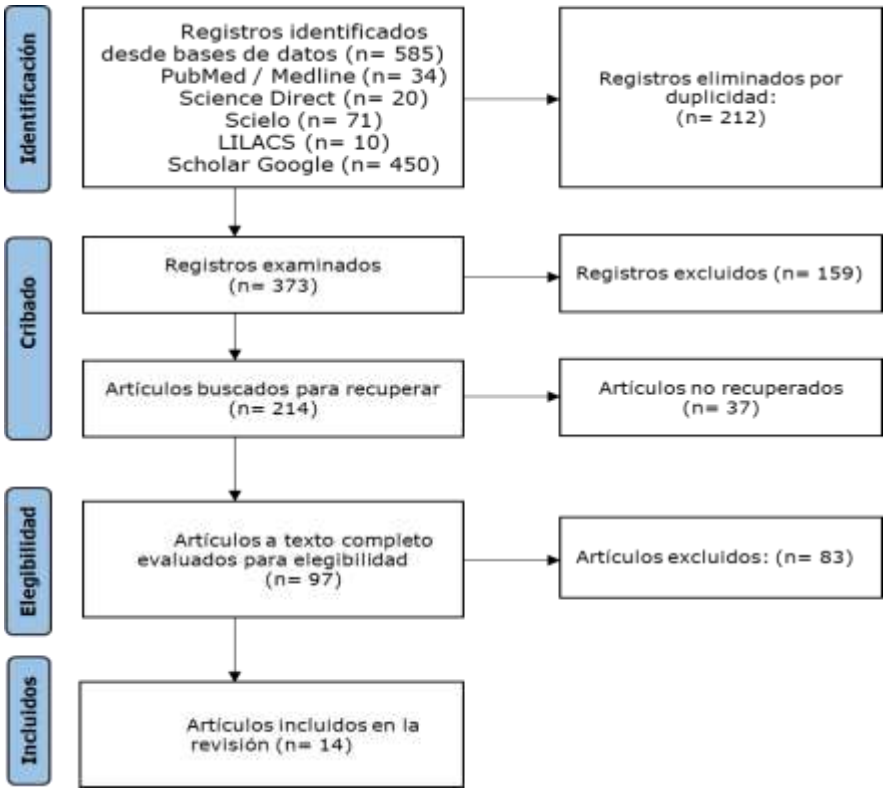

Fig. 1 PRISMA flow diagram.

Included articles were published within the defined timeframe (2010–2024) and directly addressed HA-associated tissue necrosis in rhinomodelling, glabellar filler, or lip augmentation. Clinical studies, case reports, systematic reviews, and narrative reviews providing evidence on maxillofacial complications were accepted. Excluded were duplicates, articles without full-text access, irrelevant publications, studies outside the temporal range, and documents addressing HA use in non-aesthetic areas (e.g., ophthalmology or rheumatology).

Data Extraction and Analysis

Data extraction was systematic, collecting key variables: author, publication year, study design, procedure type, sample size, main results, and conclusions. Information was organized into comparative tables to facilitate synthesis and critical analysis. A qualitative methodological approach was adopted due to study heterogeneity and the clinical nature of cases, precluding quantitative meta-analysis. Narrative synthesis focused on identifying common patterns, risk factors, prevention strategies, and tissue necrosis management protocols. Findings consistency and discrepancies were evaluated to provide an integrated, evidence-based perspective.

DEVELOPMENT

Of 373 indexed articles initially identified, exclusion criteria based on publication year, keywords, and scientific validity reduced the sample to 14 studies meeting established parameters. Table 1 summarizes findings from selected studies.

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Table 1. Synthesis of selected articles.

Source	Procedure	Results	Conclusions
Lins RGB et al. (2024) [2]	Post-HA complication management	Reduction of lumps via vaseline massage	No orofacial tissue necrosis reported. Early, appropriate intervention is crucial for managing aesthetic complications.
Valente I et al. (2023) [3]	Lip rejuvenation with HA	Improved lip volume and projection	No orofacial necrosis reported. Proper technique and anatomical knowledge are essential to avoid complications.
Destri AM et al. (2021) [5]	Multiple orofacial harmonization techniques with HA	Improved facial symmetry and wrinkle correction	No necrosis mentioned. Technique combination is effective and safe when properly performed.
Banhos PAR et al. (2022) [7]	Rhinomodelling with HA	Aesthetic improvement of nasal tip and dorsum	No necrosis reported. Procedure is safe and effective with low complication incidence when correctly executed.
Chiappina A et al. (2023) [8]	HA filler	Orofacial tissue necrosis in lips	Necrosis due to vascular occlusion reported. Early hyaluronidase intervention is critical to minimize damage.
Briceño L et al. (2023) [9]	Ultrasound characterization	Identification of necrosis complications	Ultrasound is essential for diagnosing and treating orofacial necrosis. Hyaluronidase plays a crucial role in management.
Dônola Furtado GR et al. (2020) [10]	Non-surgical rhinoplasty with HA	Necrosis of nasal tip, columella, and upper lip; progressive improvement with hyperbaric oxygen and medication	Affected areas progressed to necrosis; appropriate treatment left a small irregular superficial scar.
Pérez R et al. (2019) [12]	HA in rhinomodelling	Granulomatous complications in some cases	No necrosis mentioned. Complications managed with hyaluronidase and clinical follow-up.
Moro G et al. (2023) [13]	Lip filler with HA	Improved lip volume; vascular complications	Orofacial necrosis due to vascular occlusion reported. Early detection and hyaluronidase use are crucial to minimize damage.
Marchino Aguilar (2022) [14]	HA combined with tension threads	Facial rejuvenation and tissue repositioning	No necrosis mentioned. Combined techniques are effective and safe when properly performed, minimizing risks.

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Giachini MK (2021) [15]	Perioral rejuvenation with HA	Aesthetic and functional improvements; angular cheilitis prevention	No necrosis reported. Procedure is safe and effective when properly performed.
Duarte JFP et al. (2021) [16]	Lip filler with HA	Improved lip volume; complications like edema and hematomas	Possibility of orofacial necrosis due to accidental injection mentioned. Hyaluronidase is crucial for managing complications.
Chaves GT et al.,(2025)[17]	Lip filler with HA	Case of lower lip necrosis	Orofacial necrosis in lower lip due to vascular occlusion reported. Early detection and hyaluronidase use are essential to minimize damage.
Affonso MB et al. (2022) [18]	Subocular and malar filler with HA	Improvement in periorbital hyperpigmentation and facial rejuvenation	No necrosis reported. Procedure is safe and effective when properly performed.

Most reviewed studies reported potential necrosis cases associated with rhinomodelling, glabellar, and lip fillers, with four presenting clinical necrosis. This underscores the importance of safe injection techniques and detailed vascular anatomy knowledge. Early intervention and hyaluronidase use were highlighted as effective management methods. Studies also emphasized the need for specialized training and pre-procedural vascular mapping to minimize risks.

HA use in aesthetic and dental procedures has grown due to its biocompatibility, corrective capacity, and favorable aesthetic outcomes. [5] However, tissue necrosis remains a serious complication. [15] This discussion focuses on analyzing cases and studies of maxillofacial tissue necrosis to provide an integrated perspective.

HA is significantly used in dentistry and aesthetic medicine for facial imperfection correction, rejuvenation, and rhinomodelling. Results are typically immediate and last 12–18 months Frisina et al.,[19] contributing to its popularity. However, incorrect injection or placement in high-risk anatomical zones can lead to severe complications like necrosis—primarily due to vascular occlusion, where accidental intravascular injection obstructs blood supply, causing ischemia and cell death.[5,10,12,13,17,20]

Several studies have documented HA-associated necrosis cases. Guimarães ACRC et al.,[21] reported a case of facial artery compression after facial filler, highlighting the importance of safe injection techniques and deep anatomical knowledge. Dônola Furtado GR et al.,[10] described necrosis of the nasal tip and upper lip successfully treated with hyaluronidase, hyperbaric oxygen, and antibiotics, underscoring the need for rapid response. Belini R et al.,[20] noted that nasal necrosis—though rare—can occur even among experienced professionals, emphasizing that vascular and anatomical mapping knowledge is crucial for prevention and management.

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Prevention and treatment of HA-induced necrosis include hyaluronidase, essential for degrading HA in vascular occlusion cases.[2,10,13,20] Sim AF et al.,[22] demonstrated hyaluronidase effectiveness when administered within 24 hours of symptom onset, recommending doses of 200–300 units diluted in lidocaine (for vasodilation) or saline (to cover larger areas). If no improvement occurs within one hour, repeat dosing—up to four times—is advised. Adjunctive therapies include anticoagulants, antibiotics, and corticosteroids like betamethasone to improve perfusion and prevent infection.[12]

Anatomical knowledge and injection techniques are recurrent themes in HA literature. Several authors stress that proper professional training can determine success versus complication.[5,12] For example, Daher JC et al.,[11] emphasize detailed knowledge of high-risk anatomical zones as essential to avoid necrosis and other severe complications.

High-risk arteries include the supratrochlear and dorsal nasal arteries; most affected anatomical sites are the glabella, nasal tip, and periorbital regions.[8,18] Mattos MVB et al.,[23] also insist on knowing anatomical danger zones and using cannulas instead of needles to reduce intravascular injection risk.

One discrepancy among reviewed studies is complication frequency and severity. Some authors emphasize that severe complications like necrosis are rare and manageable if detected and treated promptly.[6,23] Conversely, Dônola Furtado GR et al.,[10] note that even small injections can cause severe complications without proper precautions. This variability may stem from differences in techniques, practitioner experience, and patient-specific factors.

Another debate concerns treatment protocols and recommended hyaluronidase dosing. While consensus exists on hyaluronidase's crucial role, specific recommendations vary. Most authors stress administration within 24 hours but differ on dose quantity and frequency. This lack of standardization reflects the need for further research to establish clear, consistent guidelines.[20,24]

Moreover, researchers consistently highlight the importance of a preventive approach in HA application. Prevention includes not only proper injection technique and anatomical knowledge but also preparedness for potential complications.[10,20] This implies having necessary tools and medications—like hyaluronidase—readily available and being trained for effective use.[25]

Continuous training and mastery of safe injection techniques are emphasized by Guimarães ACRC et al.,[21] They propose that professionals must stay updated on best practices and HA injection technology advances. Such training not only improves aesthetic outcomes but also significantly reduces severe complication incidence.

A key aspect of HA complication discussion is variability in outcomes and recommended practices. While some studies highlight the rarity of severe complications,[2,3,5,16] others warn of constant vigilance and readiness for rapid intervention.[8] This variability may be influenced by practitioner technique, product quality, and patient-specific characteristics.

The discussion on using cannulas instead of needles is also relevant. Souza PS,[6] and Sim AF et al.,[22] recommend blunt-tip cannulas to reduce intravascular injection and subsequent vascular complication risks. Though safer, this technique requires specific training and experience for correct implementation.

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Finally, early intervention is a recurring theme. Rapid recognition of complication signs and immediate action can mean the difference between full recovery and permanent injury. Daher JC et al.,[11] and Sim AF et al.,[22] emphasize that hyaluronidase administration within 24 hours is crucial to minimize damage and improve outcomes.

CONCLUSIONS

The use of hyaluronic acid in orofacial harmonization—particularly in rhinomodelling and glabellar filler—can cause maxillofacial tissue necrosis. This bibliographic review shows that, although rare, necrosis is a serious complication requiring detailed anatomical knowledge and safe injection techniques. High-risk areas include the glabella and nasal tip, with the supratrochlear and dorsal nasal arteries particularly vulnerable. Hyaluronidase is essential in complication management; although dosing lacks a standardized protocol, it should always be readily available, and optimal dosing for such complications warrants deeper investigation. Adjunctive treatments include corticosteroids (e.g., betamethasone), anticoagulants, and antibiotics. Continuous professional training and use of blunt-tip cannulas are crucial for prevention. In summary, ensuring safety and efficacy in these procedures requires rigorous preventive measures and effective therapeutic strategies.

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