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ENDOSCOPIC FOREHEAD LIFT IN COMBINATION WITH BOTULINUM THERAPY AND FILLERS: ANALYSIS OF EFFICACY AND SAFETY

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The aim: *Upper facial aging significantly impacts self-perception and quality of life as changes become apparent in the forehead, glabellar complex, and brow positioning. This narrative literature review evaluates clinical efficacy, safety profile and aesthetic outcomes of 3 treatment options: endoscopic forehead lift, botulinum toxin A and hyaluronic acid injectable dermal fillers, examining their individual and combined applications.*
Materials and methods: *Literature was obtained between April and August 2025 from electronic databases: PubMed, ScienceDirect, Google Scholar, Nature, Wiley Online Library, ResearchGate, Springer and Clinical key; using targeted search strategies. Inclusion criteria encompassed articles discussing these interventions in human participants published between 2000-2025. Exclusion criteria included mid-/lower face procedures, animal studies and non-peer reviewed editorials. Forty-one sources were selected based on clinical relevance and methodological quality.*
Results: *Endoscopic forehead lift demonstrated 93% patient satisfaction with superior long term structural repositioning. BoNT-A provided effective dynamic wrinkle reduction lasting 3–6 months with minimal complications. Hyaluronic acid fillers addressed volumetric deficits and static wrinkles lasting 6–18 months. Combined BoNT-A with HA fillers showed significantly enhanced outcomes, with 84.15% patient satisfaction at 6 months versus 55.12% with botulinum toxin A monotherapy. All modalities demonstrated excellent safety profiles with complications under 3%.*
Conclusions: *Multimodal rejuvenation addressing multiple aging mechanisms simultaneously results in superior aesthetic outcomes and patient satisfaction compared to single modality procedures. Substantial evidence gaps exist regarding optimal sequencing and long-term outcomes of combined surgical-injectable approaches. Future prospective studies examining endoscopic procedures with injectable modalities across diverse populations are essential to establish evidence-based clinical protocols*
Keywords: *upper facial rejuvenation, facial aesthetics, endoscopic forehead lift, botulinum toxin, hyaluronic acid fillers, combination therapy, patient satisfaction, safety profile, clinical efficacy*

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1. Introduction

1. 1. Importance and actuality of the problem

The human face – one of the very first aspects that meets the human eye. It plays a critical role in self-identity, interpersonal relations and communication, as well as various parts of emotional expression when perceived by others and thyself. The face can be thought as "horizontal thirds" according to the classical Da Vinci method [1]. The study will focus on the upper third region of the face – primarily on the forehead, glabellar complex and brows. Like with many other parts of the human body, this area can be susceptible to process of aging in ways like wrinkles, volume loss, skin laxity and brow descent. In current day and age, issues that arise within this area are commonly the cause as to why many patients seek cosmetic interventions.

Among many surgical options that are available today, endoscopic forehead lift has become one of the most effective and least invasive procedures seen today to elevate the brows whilst also smoothing forehead contours. The endoscopic forehead lift involves several incisions right behind the hairline, where instruments and a camera typically are inserted to lift and thoroughly secure the brow. On the other hand, non-surgical methods have become popular amongst patients in this decade, and many seek help through applications of botulinum toxin A, soft tissue fillers, thread rejuvenation or other non-invasive treatments [2].

Botulinum toxin is the most globally used injectable treatment for lessening the appearance of dynamic wrinkles. BoNT-A softens the horizontal lines and vertical frown lines, usually subtly lifting the medial brow and improving overall facial symmetry. Botulinum toxins' effects are reversible, lasting usually 3–6 months [3].

When it comes to dermal fillers, in this paper the focus will be strongly on hyaluronic acid fillers, as those

are most used when reconstructing upper facial third, especially during volume loss occurring due to aging [4]. These fillers are used to restore volume, improve given contours and soften observed static lines (which may be deep or superficial lines). In the forehead, fillers tend to be used to correct deep rhytids, fill volume-lacking temples as well as support brow complex [5].

1. 2. Research gaps and justification for the study

Despite the widespread clinical use of combined surgical and injectable approaches in the upper facial rejuvenation, evidence examining integration of endoscopic brow lift with non-surgical procedures such as botulinum or dermal filler injections remains limited. Several key gaps included combination of treatments from the start, non-consensus on optimal sequencing or timing of combining injectable with surgical approaches, long-term safety and patient satisfaction data and detecting outcomes from patients' perspectives, notably beyond 6 months. The gaps in literature that this paper will focus on identifying are assessing outcomes when endoscopic lifts, botulinum toxin and fillers are used in upper third of the face, either as single modalities or combined.

1. 3. The aim, hypothesis, objectives and research tasks

The aim of this literature study is to evaluate clinical efficacy, profile of safety and aesthetic outcomes of endoscopic forehead lifts, dermal fillers, and botulinum toxins, either combined for rejuvenation or applied solely as a single modality.

This review hypothesizes that multimodal rejuvenation, involving endoscopic lifting and when botulinum toxin and/or dermal fillers are combined – will yield in superior overall outcome – including higher patient satisfaction, better aesthetic outcomes and manageable complication rates in comparison to standalone treatments.

The primary objective of this research is to evaluate and compare clinical efficacy, safety profile and aesthetic outcomes of endoscopic forehead lifts, botulinum toxin type A and hyaluronic acid dermal fillers. To achieve the study's aim and highlight how the objectives will be achieved, the following research tasks were set:

1. Reviewing anatomical and functional aging which leads to demand of aesthetic intervention.

2. Evaluating surgical technique, indications and outcomes of endoscopic forehead lifting in aesthetic facial rejuvenation.

3. Assessing the role of botulinum toxin type A to treat wrinkles in upper third area which includes mechanism of action, application techniques and known limitations.

4. Analyzing application of dermal fillers specifically in the forehead and brow region – types of fillers, injection planes, volume restoration and possible risks.

5. Comparing efficacy, duration of effect and patient satisfaction between options used individually.

6. Evaluate clinical rationale, outcomes and safety reasonings when combining different procedures discussed in the paper.

7. Identify common complications and adverse events with each modality, both alone and if used in combination.

8. Identify gaps in current literature and proposing directions for future research and standardization in combined facial rejuvenation treatments.

2. Materials and methods

2. 1. Study design

This research is a narrative literature review which aims to analyze and gain understanding of efficacy and safety when combining techniques of endoscopic forehead lifts with components such as botulinum toxin A and dermal (hyaluronic acid) fillers. The review addresses the following questions:

– What are the clinical outcomes as well as complications when endoscopic forehead lifting is done with regards to botulinum toxin therapy and dermal fillers in the upper face area?

– What evidence exists when it comes to combined usage of these techniques, in addition what advantages, risks and limitations may be faced?

– How do combined treatment outcomes differ from single-modality treatments of given components when it comes to efficacy, safety and patient satisfaction?

2. 2. Data sources and search strategies

Literature was obtained between April and August of the year 2025 using databases and selecting appropriate key words and phrases to maximize collection of data. Electronic databases used in this study include PubMed, ScienceDirect, Google Scholar, Nature, Wiley Online Library, ResearchGate, Springer, and ClinicalKey.

Keywords and search terms included: "endoscopic forehead lift", "endoscopic brow lift", "brow lift", "forehead lift", "endoscopic techniques", "upper face rejuvenation", "combined aesthetic treatment", "botulinum toxin A", "botulinum toxin", "botox", "dermal filler", "BoNT-A", "facial aesthetics", "hyaluronic acid fillers", "complications", "patient satisfaction", "forehead rejuvenation". Boolean operators (AND/OR) were applied for more precise results. Manual searches were also performed via reference lists of key articles.

2. 3. Inclusion and exclusion criteria

Inclusion criteria included articles discussing endoscopic forehead lifts, botulinum toxins, dermal fillers or their combinations; clinical studies, reviews, expert opinions and case series; adult human participants; focus on esthetic outcomes, safety and efficacy; English language; published between 2000–2025. Exclusion criteria included mid- or lower face makeovers; any animal studies; non peer reviewed editorials; unclear methodology. In total, 41 sources were included to conduct the final review, and were selected upon their appropriate clinical relevance, diversity of approach and current trends.

Relevant data from each source was extracted into structured documents, recording authors, publication years, study designs, intervention types, outcomes (efficacy, satisfaction, complications) and limitations, then thoroughly grouped into appropriate themes to conduct concise synthesis of information collected.

This review did not involve human or animal research and thereby did not require approval from an ethics committee, as all included studies were previously published and publicly accessible with proper citations respecting author's rights and academic integrity.

Limitations include potential selection bias in article inclusion and lack of standardized quality assessment tools typical of systematic reviews resulting in less systematic rigor than formal meta-analyses, and constantly evolving nature of aesthetic procedures meaning techniques and outcome may develop beyond the review's scope.

3. Result

3. 1. Definitions and terminology

The aesthetic and functional results of endoscopic forehead lifts, along with accurate comparisons between Botox and Fillers in the given context, requires a thorough and precise knowledge of underlying anatomical structures and understanding process of aging. The section below highlights key concepts crucial for a strong foundation of a comprehensive literature review.

Key anatomical structures of the upper face

The general overview of upper third of the face is composed of the brow, forehead and temples – all 3 critical in the region of facial aesthetics. Restoring volumetrics in this area will greatly boost the upper facial rejuvenation outcomes [6]. It spreads from the hairline, down to the glabella. Knowing the anatomy helps practitioners avoid damage to underlying structures such as frontal branch of the facial nerve. Pitanguy's line functions as a common guide for estimating whereabouts of structures like the frontal branch of the facial nerve lie [7]. When it comes to upper facial muscles, especially those which play an important role in facial aging, forehead and periorbital muscles are key players. Frontalis muscle is the only muscle that lifts the eyebrows and creates horizontal forehead rhytids [8]. Brow position is controlled by balance of elevators and depressors. Primary brow depressors include orbicularis oculi (lowers the brow laterally and centrally) and procerus, corrugator supercilii, and depressor supercilii (which act medially, thereby also producing vertical and oblique glabellar lines). Aging process of the area often leads to given depressors' hyperactivity, causing ptosis and glabellar lines [9].

Fascia: the superficial temporal fascia, alternatively known as temporoparietal fascia is the initial tissue layer encountered immediately beneath the skin and underlying subcutaneous fat in the temple region. Above this point, temporal artery and vein reside. Closer to centre, this fascia will merge with galea aponeurotica. Whilst lower down, it becomes continuous with the extensive superficial musculoaponeurotic system of the lower face. Temporal branch of the facial nerve is positioned in a way superiorly to the zygoma. Deep to the superficial layers, lies the deep temporal fascia. Injury in this case may reveal deeper temporal fat cushion, potentially leading to atrophy or wasting in the area [8].

The layers of the upper face and scalp share a layered structure of SCALP: skin, subcutaneous tissue, aponeurotic layer (muscle layer, enveloping frontalis), loose areolar tissue and periosteum [7]. The innervation involves motor branch which is the frontal branch of the facial nerve (CN VII) innervating the frontalis and the corrugator. It runs along the deep surface of the superficial temporal fascia and is thereby highly vulnerable during dissection; and the sensory branch which has supraorbital and supratrochlear nerves (CN V1) provides sensation to the region. Their deep branches run close by the bone and are vulnerable during dissection of the subperiosteal [9].

Aging process

Aging of the forehead tends to manifest as rhytids and brow ptosis – commonly in the frontal, glabellar and brow areas. Problem areas tend to be separated into 2 separate categories – dynamic or hyperkinetic lines and brow ptosis. Dynamic lines results from years of pulling of the skin by underlying mimetic muscles. Three types of these hyperkinetic lines are vertical glabellar furrows (action of corrugator supercilii muscle), horizontal glabellar furrows (action of procerus muscle) and horizontal forehead creases (action of the frontalis muscle). Brow ptosis gives an angry appearance as the result of the laxity of the brow-lid complex. Laxity occurs due to gravitational and elastic changes. Brow ptosis progressing causes the development of dermatochalasis of the upper eyelids [10].

Forehead aging usually becomes evident by fourth decade with clear horizontal rhytids which tend to deepen over some time, whilst the vertical glabellar lines emerge during the fifth decade. Balance aesthetically needs that the vertical proportion of the middle third of face is equivalent to lower third – due to brow ptosis and forehead aging, middle portion tends to look squeezed. By rebuilding the top third of the face, one can restore the overall beauty and balance of the remaining countenance.

3. 2. Overview of endoscopic forehead/brow lift

Surgical technique and principles

Endoscopic forehead lifting was introduced in 1991 using fiberoptic endoscopes, showcasing a significant advancement from traditional bicoronal techniques [11]. This approach was developed to present a more minimally invasive alternative to address limitations of existing conventional methods, involving larger incisions, skin excisions, tension closure and complications including elevated frontal hairlines, skin hyperaesthesia, alopecia, and hematoma [12, 13]. Approximately half of the patients (47%) in their life had contemplated a face lift to address the worries regarding upper facial aesthetics [14].

Best patients are those with mild to moderate brow ptosis – requiring less than 1.5 of the mid-brows being elevated or having excess forehead or temporal skin [11, 15]. On the other hand, the worst candidates are those requiring a substantial amount of brow elevation (exceeding 1.5 cm), thick forehead skin, excessive wrinkle amount, and elderly patient with a generous amount of skin lost due to elasticity [15].

The surgical procedure has key 4 phases: marking protocol, anaesthesia, dissection and incisions; eyebrow release by exeresis-suction of the given fascia, muscles and periosteum; fixation, suturing, and dressing [16].

Pre-operatively, desired areas and spots of eyebrow elevation are marked (midline, lateral eyebrow and lateral limbus positions). Five small scalp incisions are to be made (1–2 cm) posteriorly to the hairline, 3 medially (dissected dorsally) and 2 temporal (dissected towards the midline) [17].

Once anaesthesia and dissection are performed – temporal incisions are then made deep into superficial temporal fascia and wide subperiosteal undermining is then performed. Endoscopic visualization is then provided for precise periosteal release, muscle myotomies, and superior identification of supraorbital vessels and nerves [17]. After selective myotomies, the eyebrows are elevated, and tissue is fixed by either temporary or permanent fixation methods. Temporary fixation is done with biodegradable screws, K-wire fixation and transcalvarial suturing (2 weeks removal). Permanent fixation uses Mitek titanium anchor for long term results [11]. Alternative fixation methods include dual cortical tunnels or fascial fusion [18].

Efficacy and aesthetic outcomes of endoscopic brow lift

Based on clinical effectiveness in one study of 57 patient who had EBL, 93% of patients reported overall surgical success, 96% would recommend the procedure to others, 89% reported satisfaction with scar appearance (mean score of 9.12 out of 10) and 95% were convinced that their surgical marks escaped the attention of other people [19]. Patient satisfaction in one study showed 80% of excellent satisfaction, 18% moderate satisfaction and substandard in only 2% [20]. Another survey of 21 plastic surgeons discovered that 50% of were satisfied and 70% of patients were satisfied with results after a 2 year follow up was performed [17].

In aesthetic improvements, patient reported benefits were that 74% were told they looked younger, 65% were seen to appear less tired/more rested, 74% reported that they felt a boost in their self-esteem and improvement in self-image [19].

One of the most common reasons many come to undergo this procedure are headaches. Headache improvement is a functional benefit provide by this approach. In patients with pre-existing headaches (28% of the study population) – 50% experienced improvement in frequency or intensity, 13% had complete resolution of regular headaches, mean reduction of 3.4 headaches per month was reported and 0.8 points less severe on a scale of 1–10 [19]. In another article, however, post operative headache was a common adverse effect found when analysing different studies [17].

Safety profile and potential complications of the treatment

The overall safety profile of an endoscopic approach demonstrates excellent safety with minimal serious complications. Analysis of patients from across various studies reveals low complications rates (most <3%). Common complications include alopecia, numbness and revision rate whilst less common complications include asymmetry, pruritus, palpability, oedema, and eye related complications. On very rare occasions (0.1%), patients may experience hematomas, infection, nerve injury, or pain [13].

Damage to the frontal branch of the facial nerve may happen and cause temporary paralysis or paresis of the said branch. Patient may be expected to fully recover from 53rd –75th day after the procedure [21]. Risk should be minimized by understanding temporal branch anatomy and careful endoscopic visualization dissection. Very rarely, scalpel scalp on the eyebrow skin may occur after resection of corrugator muscle is carried out [16]. Complications are fewer in endoscopic approach in comparison to conventional coronal incision approaches used for forehead lifting [12].

3. 3. Botulinum toxin in upper facial rejuvenation
Mechanism of action and targeted muscles

Botulinum toxin A (BoNT-A) functions as a neurotoxic protein that targets neuromuscular junction and acts at autonomic ganglia, postganglionic parasympathetic nerve endings and postganglionic sympathetic nerve endings [22]. It is produced by anaerobic rod-shaped bacteria called Clostridium botulinum, having both medical and fatal (e.g. lethal dose at 0.09 to 0.15 micrograms IV or IM) applications [23]. The process entails blocking of acetylcholine vesicles on the interior lining of cellular boundary. The toxin (BoNT) selectively and temporarily attaches to SNAREs (specialized membrane assemblies) which are the “soluble N-ethylmaleimide-sensitive factor attachment protein receptor” within the nerve ending at the muscle nerve interface [24].

The primary muscles which are aimed at during upper facial rejuvenation are divided by upper facial third region. For example, in Glabellar region – corrugator supercilii muscle (due to overactivity may lead to deep vertical wrinkles – when targeted the muscle relaxes and softens vertical frown lines), procerus muscle (due to repeated contractions, causes transverse wrinkles – Botox effect reduces horizontal glabellar lines thereby softening the harsh expressions), and depressor supercilli muscle (contributes to the eyebrow being pulled down – botulinum toxin here weakens the pull, and allows for more relaxed and elevated brow positioning; proper brow lifting). In the lateral canthal region, where frequently the issue of “crow’s feet” occurs, orbicularis oculi muscle is targeted which contains lateral fibers. Crow’s feet refer to repeated contractions at outer corners of the eyes creating radiating wrinkles; the Botox relaxes these fibers and smoothing the wrinkles whilst simultaneously preserving natural eye function. In the forehead area, frontalis muscle tends to excessively active which creates deep transverse wrinkles, which worsen with age. When treated with the injection, it softens the lines whilst maintaining a soft and natural brow movement (balanced out) [23].

Advantages and disadvantages

BoNT-A offers clinical benefits serving as minimally invasive procedure with predictable, reproducible and reversible effects lasting 3–4 months, and can be already seen on the first to fourth days after provision of the modality. After 1–4 weeks, the effect will be maximum [25]. Treatment effectively reduces dynamic and crow’s feet wrinkles with more natural looking, customi-

zable results and subtle brow elevation while reducing habitual expression that worsen wrinkles. Major psychological improvement can also be noted along with high patient satisfaction rates [26]. However, the modality presents with uncommon but still existing disadvantages such as unnatural appearance or frozen look after administration, migration, asymmetry, headaches, bruising or eye-lid drooping. Accumulation of treatment due to necessity of further treatment may also present as a possible disadvantage [27].

Factors influencing efficacy and safety

Efficacy of Botox heavily depends on migration, diffusion and spread of the substance within the treated area. Diffusion concept refers to passive transport on a microscopic level beyond the targeted injection area; spread refers to physical transportation of the toxin from point A to point B, heavily relying on injection technique, volume, size of the needle and other existing physical factors; and finally migrations refers to movement towards distal sites and may occur via neuroaxonal transport or hematogenous transport; volume and dilution of said drug plays a great effect in efficacy as well [28].

Complications/adverse events of Botox

The main complications are brow asymmetry, eyelids/eyebrows ptosis, lagophthalmos, palpebral ectropion, and prominence of palpebral eyebags [29]. Systemic side effects are allergic reactions, itching, rashes, headaches (migraines, etc.), neck or back pain, muscle stiffness, swallow difficulties and shortness of breath; less commonly but also found are nausea, abdominal pain, loss of appetite, runny nose and ringing in the ears [3]. Headaches and migraines are most frequently reported complications, followed by skin reactions e.g. bruising or hematomas at injection sites, neuromuscular symptoms at the facial region [30]. Glabellar treatment complications include periorbital muscular adverse effect occurring around the eyes due to the presence of complexing proteins which influence how effective Botulinum toxin A will be [31].

Management includes ice for local erythema, analgesics for headaches, ice/EMLA cream, or use of smaller needles for pain and antihistamines/epinephrine/steroids for hypersensitivity reactions [24].

Patient selection criteria and special considerations

Ideal patient of this modality includes – patients above 18 years old, presence of dynamic wrinkles, realistic expectations, good medical anamnesis, patient understand of treatment. Special considerations to keep in mind are concurrent use of anti-coagulants, brow asymmetry and active skin conditions [3, 23].

3. 4. Hyaluronic acid fillers in upper facial rejuvenation

Properties and types of hyaluronic acid fillers

Hyaluronic acid fillers represent the most widely used (over 2 million) category of injectable dermal fillers in modern aesthetic medicine, with exceptional longevity of 6–24 months [32]. HA can be found in the body as a naturally occurring substance, serving as base for gel-based products, which thereby explains biocompatibility profile and the low immunogenic potential. The very first FDA-approved HA filler, Restylane (Galderma), was introduced in 2003, and it marked the start of the current HA filler era [33].

Various types of HA dermal fillers contain different properties, and all differ in terms of cross-linking, its type, particle size of gel, concentration of cross-linked and observed free HA [34]. The distinguishing properties variations of these dermal fillers relate to their viscoelastic properties, primarily determined by the degree of crosslinking and process of manufacturing [34]. The elastic modulus (G') is a critical parameter and will directly influence the clinical behaviour of the filler, thereby the higher G' values (giving a greater resistance to compressive forces and more structural support), the deeper it should be injected [5].

HA fillers classified based on several important factors:

1) stiffness: more rigid fillers have more tendency to lift but some may be prone to surface imperfections, particularly when utilized on delicate dermal tissue;

2) cohesion: enhancing ideal fluidity for shaping procedures;

3) longevity: timeframe of the observed clinical outcome which varies from product to product;

4) water uptake: highly absorptive substances pose risk of oedema concerns around the orbit area;

5) degree of crosslinking: affecting durability and resistance to hyaluronidase degradation [6].

A newer category of HA fillers includes Resistant Hyaluronic Acid (RHA) products, utilizing advanced crosslinking technology – reducing degradation of HA chains during the process of production. The retention of natural HA acid molecular arrangement ultimately produces a reduced number of stronger chemical bonds for securing the material. This outcome yields a product that is less firmly interconnected. Due to these features, HA fillers can uphold an alignment with facial movements whilst simultaneously retaining their inherent elasticity [33].

Mechanism of action

HA fillers achieve their rejuvenating effect through multiple mechanisms beyond simple volumetric replacement. When injected, HA functions to stabilize, lubricate, hydrate, and enhance viscoelastic properties of extracellular matrix [33]. The approach can be described as reflation vs inflation, highlighting to restore age-diminished volume rather than creation of unnatural enhancement [6].

Beyond immediate volumetric correction and contouring, the given fillers provide sustained benefits through biological stimulation of tissue regeneration. The injected compound stimulates neocollagenesis elastin production, and ground substance synthesis through mechanical tension and direct fibroblast stimulation [6]. The observed biological response contributes to longevity results of the treatment, with facial restoration potentially causing the filler material to last beyond the appropriate period [32]. This occurs due to stimulated tissue remodelling.

Clinical applications for volume restoration and contouring

When the placement of these fillers is at periosteal level of upper facial third, this addresses contour deficien-

cies whilst simultaneously improving the skin texture through tensing effects within the tissue [33]. This technique provides additional benefits in a way where eyebrow position is enhanced through improved frontalis muscle efficiency, and restored volume will in turn create better pivot support for muscle's lever arm mechanism [6].

The aesthetic anatomy of the forehead requires a subtle prominence at the glabellar and supra-orbital rim areas, where eyebrows are positioned. When it comes to treatment planning, individual facial proportions and characteristics must be kept in mind to avoid any unnecessary over-correction that potentially could masculinize feminine features.

Another clinical application is found in temporal hollowing. Temporal volume loss plays a key part in upper third aging, which requires thorough gender specific considerations cosmetically. Female temples maintain subtle concavity in comparison to male temples. Male temples tend to be flatter or slightly convex. Temple filler can be served to harmonize the upper third area of the face with the rest of the face [35]. These fillers may also be used in brow and periorbital enhancement. Age-related subcutaneous tissue deflation causes orbital hollowing, especially in medial areas.

Efficacy in wrinkle smoothing and volumetric enhancement

Clinical efficacy will depend on multiple factors, those may include which product is being used, technique of the injection chosen and targeted anatomical location [34].

Through usage of three-dimensional imaging, studies provide quantitative evidence that HA efficacy help with volumetric enhancement. In fact, evidence shows measurable volume progressions with HA treatment, with combination to radiofrequency and this therapy shows significant reduced volume loss in comparison to HA being used as stand-alone treatment. One study utilized PRIMOS 3D analysis to document mean volume changes, providing objective efficacy measurements. Global aesthetic improvement scale (GAIS) assessments in clinical studies consistently demonstrate positive outcomes. In fact, both investigator and patient assessments show improvement scores across multiple time periods. Treatment longevity correlates with degree of crosslinking and anatomical location specifics [36].

Advantages and disadvantages

Hyaluronic acid fillers present both advantages and disadvantages in the area. These fillers offer reversibility through hyaluronidase dissolution, natural biocompatibility minimizing immunogenic reactions and room-temperature storage convenience [33]. Their versatility allows for proper customization across multiple anatomical regions with immediate visible results. Beyond the volumetric corrections, HA stimulate neocollagenesis, contributing to sustained tissue improvement [6]. Downsides to these fillers are the fact that the results are temporary, requiring repeated treatments with cumulative costs [33]. Optimal outcomes depend heavily on injector expertise and knowledge of given anatomical area. Periorbital regions require extreme caution due to thinner skin and vascular density. Hydrophilic formulations carry oedema risk, particularly in areas with limited tissue compliance as well as severe volume deficits which may exceed HA replacement capacity [34].

Safety profile and potential complications of HA fillers

Acute complications continue being rare however nerve injury may occur, causing pain, venous and impaired lymphatic drainage, extensive vascular harm resulting in contusions, localized dermal decay due to compression and tissue death along the surface [34]. Other exemplary complications include injection site reactions, Tyndall effect and nodules & granulomatous reactions. Local oedema occurs in 0.26–0.44% of cases and respond well to skin massages, hyaluronidase administrations, ice, or intralesional steroid injections when severe. Ecchymosis affects 0.23–0.35% of patient and resolves with ice packs, firm pressure or topical arnica application. Erythema develops in 0.19–0.33% of treatment and is managed with hyaluronidase, ice application or topical corticosteroids. Injection site pain is found in 0.2-0.38% of procedures, typically managed with ice pack application and analgesics when necessary [33].

Tyndall effect manifests as bluish skin discoloration caused by superficial filler placement alters light scattering patterns throughout the tissue. Complications occur in 0.03–0.11% of cases and predominantly affects thin-skin areas, for example, the lower eyelid. Management of this effect involves hyaluronidase injection, with persistent cases requiring minimal incision for filler evacuation [5, 37].

Formation of nodule and granulomatous reactions in 0.01–0.10% of cases and can be managed with multiple therapeutic approaches [5]. Initial management includes gentle message and hyaluronidase injection for HA products. Persistent nodules could require intralesional corticosteroid injection, with or without 5-fluorouracial, oral corticosteroids, or antibiotics for inflammatory cases [5, 37]. Final management of this case, considered refractor case, may require surgical excision procedure [34].

A very popular discussion among HA injections is adverse event of blindness related to the treatment. This complication of vascular occlusion is rare, however when occurs, it is very severe. It has been suggested that what impacts the outcome of blindness is volume of filler and pressure of injected. This may influence the retrograde flow into the circulation of ophthalmic area [32].

Prevention strategies rely on proper anatomical, technique and product selection knowledge. Experience factors heavily influence safety, with practitioners having more than 5 years of injection experience show 70.7% lower chance of causing vascular occlusion compared to those that have less experience. Cannula versus needle technique selection also affects safety profiles, with cannula use associated with 77.1% lower odds of vascular occlusion in comparison to needle injection [33]. However, selection of proper technique must always consider anatomical requirements and desired precision, with needles providing much better accuracy for specific structural placement requirements.

3. 5. Comparative of Botulinum toxin and Hyaluronic Acid fillers

Indications and contraindications

Understanding indications and contraindications for BTX-A and HA fillers is essential for appropriate patient selection and safe clinical practice. Table 1 presents a comprehensive comparison of the described parameters, highlighting the distinct clinical applications and safety considerations for each modality. The distinctions underscore the importance of thorough patient assessment and medical history before treatment initiation.

Table 1

Comparison of indications and contraindications between BTX-A and HA fillers

BTX-A	HA Fillers
Indications: – Dynamic wrinkles caused by muscle hyperactivity – Glabellar frown lines – Forehead horizontal lines – Periorbital crow's feet – Chemical brow lift	Indications: – Restore volume loss – Facial contouring – Deep dermal injections – Intraarticular injection – Intradermal injection for facial wrinkles or folds and perioral rhytids
Contraindications: – Pre-existing neuromuscular disorders (myasthenia gravis, amyotrophic lateral sclerosis) – Local infection at injection site – Known hypersensitivity to formulation components – Pregnancy and lactation – Concurrent aminoglycoside antibiotics or neuromuscular blocking agents – Psychiatric disorders requiring careful evaluation	Contraindications: – Known hypersensitivity to HA or lidocaine – Active skin infection or inflammation at treatment site – Pregnancy and lactation (relative contraindication) – History of severe allergic reactions – Autoimmune disorders (relative contraindication)

Data: [1, 4, 34, 38]

Duration of effects

The duration of treatment effects and maintenance requirements represent critical considerations in patient counselling and treatment planning. Table 2 illustrates the significant differences between BTX-A and HA fillers regarding longevity and factors influencing their persistence. The varying durations and maintenance schedules have significant implications for cumulative treatment costs and patient commitment to ongoing aesthetic maintenance.

Table 2

Comparison of duration between BTX-A and HA fillers.

Parameter	BTX-A	HA filler
Duration	4–6 months	6–18 months
Maintenance	Regular treatments every 4-6 months	Touch-ups may be needed every 10–12 months
Factors affecting longevity	– Muscle size and strength – Dose administration – Individual metabolism – Previous treatment history	– Filler type and cross-linking density – Injection location – Individual metabolism – Facial movement in treated area

Data: [1]

Combined treatment benefits in comparison to HA filler or botulinum toxin A as stand-alone treatments demonstrate few bonuses.

Those include:

1) longer lasting results than standalone treatment,

2) reduced frequency of maintenance treatments,

3) enhanced overall aesthetic outcomes,

4) synergistic effects improving patient satisfaction [4, 39].

Patient satisfaction: combined approach (BTX-A with HA fillers) vs BTX-A as standalone

Studies show that superior satisfaction can be achieved when combination therapy is utilized. This is shown via different time period follow ups. For example, in immediate post treatments, satisfaction rate between BTX alone and when combined with HA fillers is similar, however at a 6-month follow-up – combined therapy shows that 84.15% of patients are satisfied whilst with Botox alone it is only 55.12%. At a 9-month follow-up, 66.12% show satisfaction rate at combined therapy whilst stand-alone only 34.11%. Overall effectiveness shows that combined approach is at 60.11% marked as effective vs BTX-A monotherapy is 25.67% [40].

The HARMONY study showed the grand impact of global approach to facial rejuvenation using staged therapy of botulinum toxins, subcutaneous fillers and bimatoprost. A substantial rise in initial satisfaction scores and observed a more youthful facial look in those areas treated with combination methods [4].

Comparative side effect profiles and risk management

BTX-A specific complications include upper eyelid ptosis, brow ptosis and perio-orbital complications. Upper eyelid ptosis happens when glabella is treated and is about 1–2 mm ptosis, initially being subtle but overtime becomes more exaggerates. Caused by toxin migration through orbital septum, it can be managed by Apraclonidine 0.5% eyedrops by temporarily raising upper eyelid. It can be prevented by avoiding injections too close to orbital rim and using higher concentrations with smaller volumes. Brow ptosis is specific forehead complication; to prevent this, injections must remain 1.5–2cm superior orbital rim when targeting frontalis muscle in the outer area of mid-pupillary line. Muscle fibers located above the eyebrow in this technique are allowed to maintain activity and prevents them from sagging. Currently no treatment is available for eyebrow droop. Risks near the eyes encompass bruising, seeing double, ectropion or slumped lateral lower eyelid [1, 39].

HA specific complications include vascular occlusions, and arterial and/or venous occlusion. Vascular occlusion may happen in any location however glabella remains to be the most common site where skin necrosis can occur after injection. This happens due to surrounding arteries being in limited collateral circulation [41]. Direct arterial obstruction by filler triggers instant skin whitening and variable pain levels. Ceasing administration of injection and trying to draw out the material to reduce the pallor. Vein impediment results from too much product in a smaller zone, causing blood accumulation, constant ache, puffiness and discoloration. Emergence management should be swift and aggressive – by massaging vigorously and applying warm compresses to elevate vasodilatation. A 2% nitro-glycerine compound in form of a paste can be thought upon depending on blood pressure status that the patient has. Hyaluronidase injection may be beneficial as well as hyperbaric oxygen might be considered in case of impending necrosis or vascular compromise [1].

When assessing how these compounds may be combined and safely used, key advantages are:

1) individual treatment response,

2) reduced risk of overcorrection,

3) better adverse effects management,

4) preferred spacing between injections (first BTX-A then HA fillers after 2 weeks have passed).

During the monitoring phase and follow-ups, it is important to maintain regular assessment of 1, 6 and 9 months [40]. Emergency protocols must be followed if serious complications occur [4]. Finally, documentation and photographs must be made to accurately track treatment progress throughout the time-period [39].

The risk mitigation strategies include pre-treatment assessment, treatment protocol and post-treatment care. In pre-treatment phase requires proper medical history, allergy screening, setting realistic expectations and documenting via photographs [39]. In the final phase of understanding post-treatment care, patient must be instructed on clear after-care, informed about urgent consultations and follow-up scheduling and course of action if complications occur and how they will be managed [4].

Dosing guidelines, safety and emergency

For upper face the dosing guidelines divide into 3 regions –glabella receives 10-40 U BTX-A with superficial HA for static lines; forehead receives 6-15 U BTX-A with superficial to mid-level HA for rhytids and contouring; periorbital receives 6-15 U per side BTX-A with superficial HA filler when indicated [1]. Safety protocol relies on a 10-point planning system protocol and proper pretreatment informed consent regarding complications and emergency plan should be discussed [41].

4. Discussion

4. 1. Synthesis of findings on efficacy and safety

The narrative literature review collected evidence regarding three primary modalities in modern day upper facial rejuvenation: endoscopic forehead lift, botulinum toxin A and hyaluronic acid fillers. Each of the given interventions demonstrated distinct efficacy profiles and safety consideration that inform of proper clinical decision-making conclusions.

Endoscopic approach represents a significant advancement allowing for minimally invasive brow elevation, greatly reducing the morbidity. Evidence shows high patient satisfaction rates, 93% reporting surgical success in Panella et al., 2013. With effectiveness lying in correcting brow ptosis and providing durable structural repositioning. Technique's primary advantage lies in the ability to ultimately address gravitational tissue descent, thereby placing injectable and non-surgical modalities at a limitation. However, the procedure does require excellent surgical expertise, involving recovery time and understanding surgical risk like nerve injury (0.1%) and temporary paresis [21].

Long term durability appears superior with permanent fixation methods comparing to temporary approaches with only 7% experiencing partial loss of brow elevation versus 15.5% in temporary fixation groups [11]. This finding underscores the importance of technical precision to achieve sustainable results.

BTX-A emerged as the gold standard for dynamic wrinkle reduction in upper facial third, targeting hyperactive muscles rather than structural repositioning. Clinical applications range beyond aesthetical desires – they include functional improvements such as headache reductions (50% improvement in Panella et al, 2013). It could be argued that because of its benefits, this application could significantly help with procedures such as endoscopic brow lift, where one of the side effects is headaches.

Limitations of botulinum toxin A as a single method, is its inability to address static wrinkles, volume loss or tissue laxity. Duration of the effect last from 3 to 6 months, making it necessary for regular sessions, contributing to accumulation of costs. Complications tend to be minor, they include brow ptosis, eyelid ptosis and headaches, emphasizing the importance of anatomical knowledge and conservative understanding of strategies of the dosing.

Hyaluronic acid fillers primarily address issues of volumetric deficits and static wrinkles through approach of immediate physical correction and sustained tissue remodelling via neocollagenesis. Evidence supports effectiveness in forehead contouring temporal hollowing

correction and periorbital enhancement, when applied with appropriate product selection and injection technique [33]. Duration of effect lasts from 6–18 months, exceeding that of BTX-A. However, with that in mind, HA will ultimately require more maintenance. Practitioners which exceed 5 years of experience demonstrate 70.7% lower odds of complications such as vascular occlusion [33].

Combined BTX-A with HA fillers show superior outcomes in comparison to when used alone. Zhu and Chandran (2023) showed 84.15% patient satisfaction at about 6 months with combinations therapy whilst when BTX-A was used alone, the rate was only 55.12%.

Study limitations. The narrative review lacks systematic rigor of formal meta-analyses, with potential selection bias and absence of standardized quality assessment tools. A critical gap exists in evidence examining endoscopic forehead lift combined with injectable modalities. However, this gap represents a valuable finding: it demonstrates that despite global clinical adoption of combined approaches, rigorous evidence which guides their decisions and offers to patients remains absent. This narrative review shows current evidence on individual modalities and some when combined, highlighting the importance and crucial understanding towards where the research must be directed towards in the future. Long term outcome data, which is more than 12 months, remains scarce, particularly in those studies analyzing combined approaches.

Literature demonstrates limited demographic diversity, restricting generalizability. Publication bias may influence reported outcomes, with positive results more likely published than neutral or negative findings.

Prospects for further research. Priority when it comes to the future should be given to prospective and possibilities of studies done to examine endoscopic forehead lift combined with BTX-A and/or HA fillers, addressing optimal timing, impact on outcomes, comparative durability and cost effectiveness. Safety surveillance tracking cumulative effects of repeated treatments over decades is needed. Future studies must prioritize and focus more on diverse patient populations to establish treatment options for different ethnicities, skin types and gender identities.

5. Conclusion

This narrative literature review evaluated clinical efficacy, safety profiles and aesthetic outcomes of the three primary modalities for upper facial rejuvenation: endoscopic forehead lift, botulinum toxin A (BTX-A or BoNT-A) and hyaluronic acid (HA) fillers.

Endoscopic forehead lift demonstrated:

– 93% patient satisfaction with surgical success;

– Superior long term structural repositioning for brow ptosis correction;

– Lower complication rates (< 3%) with nerve injury occurring in only 0.1% of cases;

– Functional benefits including 50% improvement in pre-existing headache frequency.

Botulinum toxin A showed:

– Effective dynamic wrinkle reduction lasting 3–6 months;

– Minimal complications with high safety profile;

– Therapeutic benefits beyond aesthetics, including headache management;

– Limitations in addressing static wrinkles and volumetric deficits.

Hyaluronic acid fillers provided:

– Volumetric restoration and static wrinkle correction lasting 6–18 months;

– Reversibility through hyaluronidase dissolution;

– Neocollagenesis stimulation for sustained tissue improvement;

– Excellent safety when administered by experienced practitioners (> 5 years' experience associated with 70.7% lower complication odds).

Combined therapy (BoNT-A with HA fillers) achieved:

– 84.15% patient satisfaction at 6 months versus 55.12% with BoNT-A monotherapy;

– 60.11% overall effectiveness compared to 25.67% with BoNT-A alone;

– Synergistic benefits addressing multiple aging mechanisms simultaneously.

Clinical implications were analysed and broken down in sections for treatment selection guidelines, safety considerations, and patient counselling requirements.

Based on treatment selection guidelines, no single modality addresses all components of upper facial aging, thereby the clinical decision making should be guide by:

– Structural concerns (brow ptosis, tissue decent) – endoscopic forehead lift

– Dynamic wrinkles (muscle hyperactivity) – botulinum toxin A

– Volume loss and static wrinkles – hyaluronic acid fillers;

– Comprehensive rejuvenation – multimodal combination therapy;

All three modalities showed excellent safety profiles when performed by trained practitioners:

– Complications rates remained below 3% across all interventions;

– Combined injectable therapy (BoNT-A + HA fillers) showed superior outcomes without increased adverse events;

– Proper anatomical basis of understanding and technique selection are critical points to minimize risks.

Patient counselling requirements brings attention to clinicians' responsibility to inform patients about:

– Duration of effects and maintenance requirements for each modality;

– Realistic aesthetic expectations based on individual aging patterns;

– The evidence gap regarding combined surgical-injectable approaches;

– Cost-benefit consideration of single versus multimodal treatments.

Despite the widespread clinical adoption, rigorous evidence examining endoscopic forehead lift combined with BTX-A and/or HA fillers remains absent. Therefor this creates the primary gap between surgical and injectable combinations. Specific areas requiring further investigation include:

– Optimal timing and sequencing of surgical and injectable interventions;

– Safety profile of combined approaches;

– Long term durability of combined treatments;

– Cost-effectiveness analysis.

Secondary gaps in current literature also remain and those are:

– Long term outcome data (>12 months) for combined injectable approaches;

– Studies across diverse demographic populations (ethnicity, skin types, gender identities);

– Standardized protocols for treatment sequencing and dosing;

– Cumulative safety data for repeated treatments over decades.

The challenge to verify hypothesis remained. Primary hypothesis stating that multimodal rejuvenation yields superior outcomes were:

– Confirmed: BoNT-A combined with HA fillers based on substantial evidence;

– Not confirmed: for endoscopic lift combined with injectables due to insufficient published data.

Secondary hypothesis with optimal integration protocols remained unverifiable due to literature lacking comparative studies examining optimal sequencing and timing of combined surgical-injectable approaches.

Recommendation for future research and priority studies needed are prospective randomized controlled trials, long term surveillance studies and diverse population studies. Prospective randomized controlled trials should examine:

– Endoscopic forehead lift with BoNT-A;

– Endoscopic forehead lift with HA fillers;

– Endoscopic forehead lift with combined injectables (BoNT-A and HA fillers).

Long term surveillance studies (> 5 years) evaluating:

– Durability of combined treatments;

– Cumulative safety effects

– Cost-effectiveness compared to repeat monotherapy.

Finally, diverse population studies must include:

– Multiple ethnic backgrounds;

– Various skin types;

– Different gender identifies and age groups.

Standardization requirements for future studies should establish:

– Evidence based clinical protocols for treatment sequencing;

– Standardized outcomes measurement tools;

– Guidelines for patient selection criteria;

– Emergency management protocols for combination therapy.

Limitations of the current practice remains that current approaches when it comes to combining surgical-injectable modalities are based on reasoning and not direct evidence. Practitioners must:

– Exercise conservative treatment planning when combining modalities;

– Provide thorough informed consent regarding evidence gap;

– Maintain vigilant monitoring for unexpected interactions;

– Document outcomes systematically contributing to evidence base.

In conclusion, whilst substantial evidence supports efficacy and safety of endoscopic forehead lift, BTX-A, and hyaluronic acid fillers as individual modalities or combination of BTX-A and HA fillers, the integration of surgical and injectable approaches remains evidence poor frontier. Practitioners possess powerful tools for upper facial reconstructions yet lacking comprehensive evidence foundation necessary to optimize their combined application. Bringing light to the given gap through rigorous clinical studies will show the need in advancing in the given field, toward truly creating a stable evidential base for clinicians to rely on and create personalized facial rejuvenation with maximal patient results whilst maintaining highest standards of safety and efficacy.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research, and its results presented in this article.

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Use of Artificial Intelligence

Artificial intelligence tools were used minimally in preparation of this manuscript, limited to grammar, spelling and punctuation correction only. Specifically Grammarly Premium was used to review and refine the English language presentation of the manuscript sections to ensure clarity and readability. All corrections suggested by the AI tool were reviewed by author. Corrections were retained if they improved clarity without altering content, meaning or scientific accuracy.

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Authors' contributions

Nelli Pankovets: Conceptualization, Methodology, Investigation, Data extraction and synthesis, Writing-original draft, Writing-review and editing.

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