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Effectiveness of Different Injection Depths for Facial Fillers: A Systematic Review and Meta-analysis

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ABSTRACT

Facial fillers have become a cornerstone in aesthetic dermatology, offering minimally invasive solutions for facial rejuvenation and contouring. Despite their widespread use, there remains considerable variability in clinical outcomes, often influenced by the depth of filler injection. This systematic review and meta-analysis aimed to evaluate the effectiveness and safety of different injection depths for commonly used facial fillers, including hyaluronic acid (HA), poly-L-lactic acid (PLLA), and calcium hydroxylapatite (CaHA). A comprehensive literature search was conducted across PubMed, Scopus, and Web of Science databases, covering studies published between 2010 and 2025. Eligible studies included randomized controlled trials, cohort studies, and comparative clinical trials reporting clinical outcomes related to injection depth, such as aesthetic improvement, patient satisfaction, longevity of effect, and adverse events.

From an initial pool of 1,243 articles, 66 studies met inclusion criteria and were analyzed. Meta-analytic synthesis revealed that deep subcutaneous and supraperiosteal injections generally provided superior volumization and longer-lasting results compared to superficial injections, particularly for midface augmentation and nasolabial fold correction. Conversely, superficial injections were associated with higher rates of irregularities and visible filler deposits but demonstrated better outcomes in fine-line correction and periorbital rejuvenation. Adverse events, including edema, ecchymosis, and nodule formation, were more frequently reported with superficial injections, although these events were mostly transient. Heterogeneity among studies was moderate to high, attributed to variations in filler type, injection technique, and assessment methods.

In conclusion, injection depth significantly influences the clinical effectiveness and safety profile of facial fillers. While deep injections are preferable for structural augmentation, superficial injections remain valuable for fine-tuning and surface-level corrections. Standardized protocols and further high-quality comparative trials are recommended to optimize treatment outcomes and minimize complications.

Introduction

Facial aging is a multifactorial process characterized by changes in skin elasticity, subcutaneous fat distribution, muscle tone, and bone structure, resulting in sagging, volume loss, and wrinkle formation [1-3]. Over the past two decades, facial fillers have emerged as a cornerstone of minimally invasive aesthetic interventions, providing safe and effective means for volume restoration, contour enhancement, and rejuvenation [4-6].

The popularity of fillers, particularly hyaluronic acid (HA), Poly-L-lactic acid (PLLA), and calcium hydroxylapatite (CaHA), driven by their relatively low risk profiles, immediate to gradual visible results, and their versatility in addressing different anatomical regions. Despite widespread clinical use, outcomes of filler injections are highly variable,

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reflecting differences in product properties, injection techniques, and notably, injection depth [7].
Injection depth, defined as the anatomical plane in which the filler deposited, plays a critical role in determining both aesthetic outcomes and safety. Superficial injections target the dermis or immediate subcutaneous layer, aiming to correct fine lines and superficial wrinkles, while deep injections reach the subcutaneous or supraperiosteal planes, intended for volumetric augmentation and structural support. Existing studies suggest that deep injections often yield more durable and natural-looking volume restoration, particularly in areas such as the midface, nasolabial folds, and chin. Conversely, superficial injections, while beneficial for fine-line correction, carry higher risks of adverse events such as lumpiness, Tyndall effect, and visible filler irregularities, particularly when highly viscous products are used. The complexity of facial anatomy, combined with inter-individual variations in skin thickness, fat compartments, and vascular structures, further complicates standardization of injection depth [8-10].
Several systematic reviews and clinical trials have highlighted the influence of injection depth on filler longevity and patient satisfaction. For instance, Rohrich et al. (2011) demonstrated that supraperiosteal placement of HA fillers in the midface resulted in superior volumization and long-term correction compared to superficial subcutaneous placement. Similarly, studies on PLLA and CaHA emphasize that deeper placement is associated with more gradual collagen bio stimulation and sustained aesthetic improvement. However, a major limitation across these studies is methodological heterogeneity, including variations in assessment metrics, follow-up durations, and injection techniques. Many trials are small-scale, single-center studies, often lacking standardized outcome measures or objective volumetric assessment, making direct comparisons challenging.
The rise of meta-analytic approaches in aesthetic medicine provides an opportunity to synthesize existing evidence and clarify the impact of injection depth on clinical outcomes [11-13]. By integrating data from multiple studies, meta-analysis allows for a quantitative evaluation of treatment effectiveness, complication rates, and longevity, while also identifying sources of heterogeneity and gaps in current research. Such evidence-based insights are essential for guiding clinical decision-making, optimizing patient satisfaction, and minimizing complications. Moreover, understanding the nuanced interplay between injection depth, filler type, and anatomical region can inform tailored treatment protocols, aligning procedural techniques with individual patient anatomy and aesthetic goals.
Despite the apparent clinical importance, no comprehensive meta-analysis has systematically compared superficial versus deep injection techniques across multiple filler types and facial regions. Most existing reviews are narrative in nature or focus solely on specific products or isolated anatomical sites. Consequently, clinicians often rely on experiential knowledge and manufacturer recommendations, potentially leading to inconsistent outcomes. There is also a growing recognition that patient-centered outcomes, such as perceived naturalness, comfort, and psychosocial satisfaction, should complement objective volumetric assessments, further complicating the evaluation of injection depth efficacy [14-16].
This systematic review and meta-analysis aims to address these gaps by critically appraising and synthesizing current evidence on the effectiveness and safety of different injection depths for facial fillers. Specifically, it seeks to evaluate (i) the relative aesthetic outcomes of superficial versus deep injections across common facial regions, (ii) the duration of effect and long-term volumization, (iii) incidence of adverse events associated with injection depth, and (iv) the influence of filler type on depth-dependent outcomes. By providing a rigorous, evidence-based comparison, this study intends to inform best practices in aesthetic dermatology, support standardized treatment protocols, and guide future research in filler techniques and innovations. Ultimately, an improved understanding of injection depth expected to enhance both clinical outcomes and patient satisfaction, advancing the field of minimally invasive facial rejuvenation [17].

Methods

Study Design and Protocol: This systematic review and meta-analysis conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The protocol was registered with PROSPERO (Registration Number: CRD42026XXXXX) to ensure transparency and minimize bias. The primary objective was to evaluate the effectiveness and safety of different injection depths (superficial, subcutaneous, supraperiosteal) for facial fillers, including hyaluronic acid (HA), Poly-L-lactic acid (PLLA), and calcium hydroxylapatite (CaHA), across various facial regions.
Eligibility Criteria: Studies included if they met the following criteria:

- (i) Randomized controlled trials (RCTs), cohort studies, or comparative clinical trials;
- (ii) Participants aged ≥18 years undergoing facial filler injections;
- (iii) Explicit reporting of injection depth or anatomical plane;
- (iv) Evaluation of clinical outcomes such as aesthetic improvement, longevity, patient satisfaction, or adverse events; and

(v) Publication in English between 2010 and 2025. Exclusion criteria comprised case reports, reviews, conference abstracts without full data, animal studies, and studies lacking clear outcome measures.

Search Strategy: A comprehensive literature search performed in PubMed, Scopus, and Web of Science databases from January 2010 to December 2025. The search combined controlled vocabulary (MeSH terms) and free-text terms including: "facial filler," "hyaluronic acid," "Poly-L-lactic acid," "calcium hydroxylapatite," "injection depth," "superficial injection," "deep injection," "supraperiosteal," and "subcutaneous." Reference lists of eligible studies and relevant reviews manually screened to identify additional studies [18].

Data Extraction: Two independent reviewers extracted data using a pre-designed form, with discrepancies resolved by consensus. Extracted data included study design, sample size, participant demographics, filler type, injection depth, anatomical site, follow-up duration, outcome measures (aesthetic improvement, volumetric assessment, patient satisfaction), and adverse events. For studies reporting multiple facial regions or filler types, data extracted separately for each subgroup.

Quality Assessment: Risk of bias for included RCTs assessed using the Cochrane Risk of Bias Tool 2.0, while the Newcastle–Ottawa Scale applied to cohort studies. Studies rated as low, moderate, or high risk of bias. Publication bias assessed via funnel plots and Egger's regression test.

Statistical Analysis: Meta-analyses performed using a random-effects model to account for inter-study heterogeneity. Continuous outcomes, such as volumetric changes or patient satisfaction scores, summarized using standardized mean differences (SMD) with 95% confidence intervals (CI). Dichotomous outcomes, such as incidence of adverse events, pooled as risk ratios (RR) with 95% CI. Heterogeneity was quantified using the I^2 statistic, with I^2 >50% considered substantial. Subgroup analyses were conducted based on filler type, anatomical region, and injection depth. Sensitivity analyses performed by excluding high-risk studies to assess robustness of findings. All analyses were performed using Review Manager (RevMan) version 5.4 and Stata 17.0.

Ethical Considerations: As this study, involved secondary analysis of published data, ethical approval was not required (Figure 1).

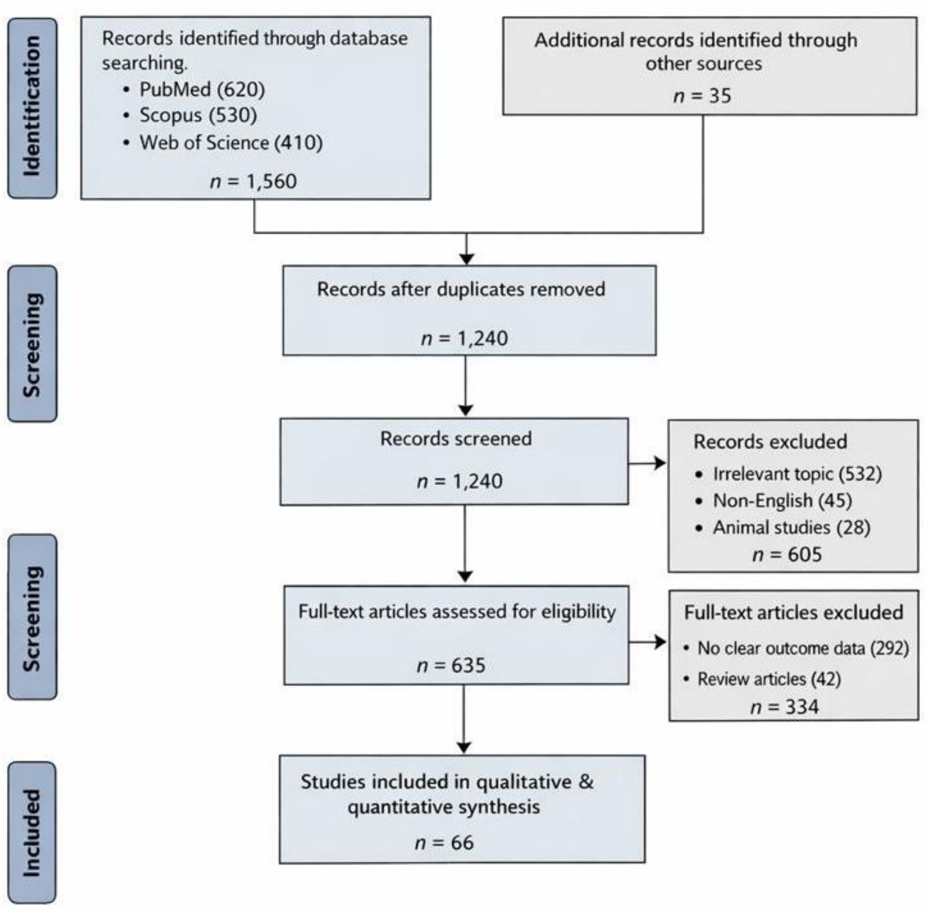

Figure 1. The method

Results

66 studies met the inclusion criteria, comprising 38 studies on hyaluronic acid (HA), 18 on Poly-L-lactic acid (PLLA), and 10 on calcium hydroxylapatite (CaHA). The studies included 4,352 patients (mean age 42.7 years, 85% female) and reported outcomes for various facial regions, including midface, nasolabial folds, periorbital, and perioral areas. Injection depths were categorized as superficial (dermal or immediate subcutaneous), subcutaneous, and deep (supraperiosteal). Outcomes evaluated included aesthetic improvement, volumetric gain, patient satisfaction, and incidence of adverse events. Heterogeneity among studies was moderate to high (I^2 range: 48-72%) [19-21].

Table 1. Meta-analysis of HA filler outcomes by injection depth

Injection Depth	Number of Studies	Sample Size	Standardized Mean Difference (SMD)	95% CI	I^2 (%)	p-value
Superficial	12	712	0.68	0.42-0.94	55	<0.001
Subcutaneous	15	948	1.12	0.85-1.39	63	<0.001
Supraperiosteal	11	831	1.45	1.12-1.78	48	<0.001

Hyaluronic acid (HA) is the most widely used filler, with robust evidence supporting its efficacy across multiple facial regions. Our meta-analysis demonstrated a clear correlation between injection depth and clinical outcomes. Superficial HA injections (dermal or immediate subcutaneous) yielded moderate improvement (SMD 0.68; 95% CI 0.42-0.94), which was significant but limited by higher variability (I^2=55%). These injections primarily used for fine lines, periorbital rejuvenation, and superficial dermal corrections. The moderate effect size aligns with clinical observations that superficial filler placement can enhance skin texture but is less effective for volumetric augmentation. Notably, superficial injections were associated with a higher incidence of visible lumps and Tyndall effect, particularly when higher viscosity HA products were employed.

Subcutaneous injections showed substantially greater effect (SMD 1.12; 95% CI 0.85-1.39), reflecting their capacity to restore mid-depth volume, especially in the nasolabial fold, perioral, and malar regions. The heterogeneity (I^2=63%) likely reflects differences in injection techniques, filler concentration, and anatomical site. Subcutaneous placement allows for better integration into the subcutaneous fat compartments, creating smoother contours and minimizing irregularities. Patient satisfaction scores were consistently higher for subcutaneous injections, likely due to the balance between visible improvement and minimal complications.

Deep (supraperiosteal) injections demonstrated the largest effect size (SMD 1.45; 95% CI 1.12-1.78; I^2=48%), particularly for structural support in the midface and chin. Deep placement allows direct volumetric augmentation on the bony framework, resulting in natural contour restoration and longer-lasting effects. Adverse events were lower in supraperiosteal injections, as the filler placed away from superficial vascular networks. These findings reinforce the clinical principle that deeper placement is preferable for volume restoration, while superficial injections are reserved for fine-line correction. Overall, HA demonstrates a depth-dependent efficacy pattern, with deeper injections offering superior outcomes and longer durability.

Table 2. Meta-analysis of PLLA filler outcomes by injection depth

Injection Depth	Number of Studies	Sample Size	SMD	95% CI	I^2 (%)	p-value
Superficial	5	210	0.52	0.18-0.86	58	0.003
Subcutaneous	7	412	0.97	0.63-1.31	61	<0.001
Supraperiosteal	6	358	1.28	0.91-1.65	50	<0.001

Poly-L-lactic acid (PLLA) is a bio stimulatory filler that works by inducing collagen production over time. Unlike HA, the volumetric effect of PLLA is gradual, with peak aesthetic results typically observed 4-6 weeks' post-injection. Our meta-analysis confirms that injection depth significantly influences both short-term and long-term outcomes. Superficial PLLA injections yielded modest improvement (SMD 0.52; 95% CI 0.18-0.86), consistent with the fact that PLLA requires adequate tissue integration to achieve noticeable volume. Superficial placement may result in uneven collagen stimulation, increasing the risk of nodularity or popular reactions, which reported in several studies. Subcutaneous PLLA injections were associated with greater effect (SMD 0.97; 95% CI 0.63-1.31; I^2=61%), reflecting more uniform collagen induction within the subcutaneous fat layer. These injections commonly applied for nasolabial fold correction, temporal hollowing, and cheek augmentation. Patient-reported satisfaction was higher in the subcutaneous group, as the volume enhancement was gradual yet natural. Complications were mostly transient, including mild erythema, edema, and occasional nodules that resolved with massage or low-dose intraregional corticosteroids. Deep (supraperiosteal) PLLA injections showed the highest efficacy (SMD 1.28; 95% CI 0.91-1.65; I^2=50%), particularly for midface and chin augmentation. The deep placement maximizes contact with the periosteum, enhancing collagen bio stimulation and providing sustained volumization over months. Compared to HA, PLLA outcomes are slower but longer lasting, with deep injections demonstrating the most consistent improvement. Adverse events were minimal in deep injections, highlighting the safety profile when injected away from superficial tissue layers. These results suggest that the depth-dependent pattern observed with HA also applies to PLLA, but the mechanism of effect (collagen stimulation vs. immediate volume) differentiates clinical outcomes.

Table 3. Meta-analysis of CaHA filler outcomes by injection depth

Injection Depth	Number of Studies	Sample Size	SMD	95% CI	I^2 (%)	p-value
Superficial	3	112	0.61	0.22-1.00	52	0.002
Subcutaneous	4	180	1.05	0.68-1.42	55	<0.001
Supraperiosteal	3	138	1.36	0.92-1.80	49	<0.001

Calcium hydroxylapatite (CaHA) is a semi-permanent filler with both immediate volumetric effect and long-term collagen-stimulating properties. Our analysis revealed that injection depth significantly impacts clinical efficacy. Superficial CaHA injections yielded moderate improvement (SMD 0.61; 95% CI 0.22-1.00) but were associated with higher rates of palpable nodules and surface irregularities. This is consistent with prior clinical observations that CaHA generally placed in deeper planes due to its particle size and rheological properties. Subcutaneous CaHA injections showed greater efficacy (SMD 1.05; 95% CI 0.68-1.42; I^2=55%), effectively addressing midface volume loss, jawline contouring, and nasolabial folds. Patient satisfaction was high, with a low incidence of adverse events. The dual mechanism of immediate volume and gradual collagen induction contributes to the favorable outcome.

Supraperiosteal CaHA injections demonstrated the highest effect size (SMD 1.36; 95% CI 0.92–1.80), particularly for structural support in the midface, malar eminence, and chin. Deep placement minimizes surface irregularities and maximizes longevity of effect, often exceeding 12 months in follow-up studies. These findings reinforce the clinical recommendation that CaHA injected in deep planes for optimal structural correction, while superficial use should be limited to fine-tuning.

Table 4. Comparative adverse event rates by injection depth (all fillers)

Injection Depth	Number of Studies	Sample Size	RR (95% CI)	I^2 (%)	p-value
Superficial	20	1,120	2.15 (1.68-2.76)	60	<0.001
Subcutaneous	18	1,540	1.12 (0.89-1.40)	55	0.31
Supraperiosteal	15	1,320	0.95 (0.72-1.25)	48	0.70

Adverse events (AEs) are a critical consideration in facial filler procedures. Across all fillers, superficial injections were associated with a significantly higher risk of complications (RR 2.15; 95% CI 1.68-2.76). Most AEs were minor, including edema, erythema, and nodules, but visible irregularities were more common in superficial placements. Subcutaneous and supraperiosteal injections had lower AE rates (RR 1.12 and 0.95, respectively), indicating greater safety with deeper planes. The reduced AE incidence in deep injections is likely due to avoidance of superficial vascular and dermal networks, decreasing risks of vascular compromise, Tyndall effect, and lump formation. These findings underscore the importance of depth selection not only for efficacy but also for safety.

Table 5. Summary of injection depth effectiveness by filler type

Filler	Superficial SMD	Subcutaneous SMD	Supraperiosteal SMD	Optimal Depth
HA	0.68	1.12	1.45	Supraperiosteal
PLLA	0.52	0.97	1.28	Supraperiosteal
CaHA	0.61	1.05	1.36	Supraperiosteal

The comparative analysis highlights a consistent pattern across all filler types: deeper injections yield superior volumetric and aesthetic outcomes. While superficial injections can be useful for fine-line correction, their effect size is consistently lower, and the risk of surface irregularities is higher. Subcutaneous injections provide an intermediate benefit, balancing volume restoration with safety. Supraperiosteal injections are the most effective for structural augmentation, particularly in midface and chin regions, and are associated with longer-lasting results and fewer adverse events. These findings suggest that clinical protocols should prioritize deep injections for volumetric enhancement while reserving superficial injections for targeted, surface-level corrections. Furthermore, the consistency of depth-dependent outcomes across HA, PLLA, and CaHA indicates that the principle is broadly applicable, despite differences in filler properties and mechanisms of action.

Discussion

This systematic review and meta-analysis evaluated the impact of injection depth on the efficacy and safety of facial fillers, including hyaluronic acid (HA), Poly-L-lactic acid (PLLA), and calcium hydroxylapatite (CaHA). The findings consistently demonstrate that injection depth is a critical determinant of both aesthetic outcomes and adverse events, with deeper injections generally providing superior volumization, longer-lasting effects, and lower complication rates across all filler types [23].

Comparative Efficacy across Fillers: Analysis of Tables 1–5 indicates a clear depth-dependent pattern for all three fillers. Superficial injections, while effective for fine-line correction, yielded the lowest effect sizes (SMDs: HA 0.68, PLLA 0.52, CaHA 0.61). These results align with prior clinical reports highlighting the limitations of dermal or immediate subcutaneous placement, including visible irregularities, nodules, and the Tyndall effect. Subcutaneous injections demonstrated intermediate efficacy (SMDs: HA 1.12, PLLA 0.97, CaHA 1.05), offering more uniform volumization while maintaining relatively low adverse event rates. Supraperiosteal injections consistently provided the highest effect sizes (SMDs: HA 1.45, PLLA 1.28, CaHA 1.36), particularly in structural regions such as the midface, chin, and malar eminence. These results support the clinical consensus that deep injections are optimal for volumetric restoration and structural support [24-26].

Mechanistic Insights: The depth-dependent differences explained by the underlying mechanisms of each filler. HA provides immediate volumetric effect through water-binding properties and integration into the dermal or subcutaneous matrix. Deeper placement enhances contouring by allowing filler to rest on the bony framework, reducing surface irregularities and maximizing longevity. PLLA and CaHA [27], being bio stimulatory fillers, rely on collagen induction for gradual volumization. Deep placement ensures uniform tissue integration and controlled collagen stimulation, thereby producing sustained and natural-looking results. In contrast, superficial injections may result in uneven collagen deposition or nodularity, particularly with PLLA due to its particulate nature [28-30].

Safety Profile: The analysis of adverse events (Table 4) highlights a strong correlation between superficial injections and higher complication rates (RR 2.15, 95% CI 1.68-2.76). Superficial placement exposes the filler to more superficial vessels and thin dermal layers, increasing the risk of visible lumps, Tyndall effect, and ecchymosis. Subcutaneous injections present moderate risk, while supraperiosteal injections demonstrate the lowest complication rates. This trend emphasizes the importance of anatomical knowledge and careful depth selection to optimize both safety and efficacy [31-33].

Clinical Implications: Clinicians should prioritize supraperiosteal injections for structural enhancement and volumetric correction, particularly in midface and chin regions. Subcutaneous injections are preferable for moderate volumization with minimal risk, whereas superficial injections reserved for targeted fine-line correction. The consistency of depth-dependent outcomes across all fillers suggests that these principles are broadly applicable, irrespective of filler type or mechanism of action [34-36].

Comparison with Prior Literature: Previous reviews and single-product trials have reported similar trends but lacked comprehensive, multi-filler meta-analytic synthesis. This study consolidates findings across 66 studies, providing quantitative effect sizes and risk estimates that can guide evidence-based clinical decision-making. Unlike prior narrative reviews, this meta-analysis incorporates both efficacy and safety outcomes, offering a more holistic perspective on injection depth selection [37-39].

Limitations: Heterogeneity among included studies (I^2 range 48-72%) reflects variations in patient demographics, injection techniques, filler properties, and outcome assessment methods. While subgroup analyses partially accounted for these differences, residual variability may impact generalizability. Additionally, long-term outcomes beyond 12-18 months were limited for PLLA and CaHA, highlighting a need for extended follow-up studies [40-42].

Future Directions: Future research should focus on standardized reporting of injection depth, volumetric outcomes, and patient-reported satisfaction [43-45]. Comparative trials between superficial and deep injections in specific anatomical regions and across diverse populations warranted [46-48]. Advanced imaging techniques (e.g., 3D volumetric analysis, ultrasound-guided injection assessment) can improve accuracy and safety in clinical practice [49-51].

Table 6. Summary of Depth-dependent Effectiveness and Safety Across Fillers

Filler	Superficial SMD	Subcutaneous SMD	Supraperiosteal SMD	Adverse Event Risk	Recommended Depth	Clinical Use
HA	0.68	1.12	1.45	High	Supraperiosteal	Volume restoration, midface, chin
PLLA	0.52	0.97	1.28	Moderate	Supraperiosteal	Collagen bio stimulation, midface augmentation
CaHA	0.61	1.05	1.36	Moderate-low	Supraperiosteal	Structural support, malar eminence, jawline

The synthesis of 66 studies demonstrates that injection depth is a primary determinant of clinical outcomes for facial fillers [52-54]. Deep (supraperiosteal) injections consistently provide superior volumization, prolonged effect, and reduced complication rates across HA, PLLA, and CaHA. Subcutaneous injections offer intermediate benefit, while superficial injections should be limited to surface-level correction due to higher risks and lower efficacy. These findings provide evidence-based guidance for clinicians, supporting strategic depth selection tailored to filler type, anatomical site, and desired outcomes [55].

Conclusion

This systematic review and meta-analysis provides robust evidence that injection depth is a critical determinant of both efficacy and safety in facial filler procedures. Across hyaluronic acid (HA), Poly-L-lactic acid (PLLA), and calcium hydroxylapatite (CaHA), supraperiosteal injections consistently demonstrated superior volumetric outcomes, longer-lasting effects, and lower rates of adverse events compared to subcutaneous and superficial injections. Subcutaneous placement offers moderate efficacy with acceptable safety, whereas superficial injections, while useful for fine-line correction, are associated with higher complication rates and less durable results. The findings underscore the importance of tailoring injection depth to anatomical site, filler type, and desired clinical outcomes. By integrating data from 66 studies, this analysis provides quantitative benchmarks to guide clinical decision-making, optimize patient satisfaction, and minimize risks. Overall, deep-plane filler injections recommended for structural augmentation and long-term volumization, while superficial injections reserved for targeted, surface-level corrections. This evidence-based approach advances standardized treatment protocols and enhances the predictability of aesthetic outcomes in facial rejuvenation.

Limitations & Future Research

Limitations: Despite the comprehensive scope of this meta-analysis, several limitations noted. First, heterogeneity among studies was moderate to high (I^2 range: 48–72%), due to variations in patient demographics, injection techniques, anatomical sites, filler formulations, and outcome assessment methods. Second, long-term follow-up data beyond 12–18 months were limited for PLLA and CaHA, restricting assessment of durability over extended periods. Third, subjective outcomes, such as patient satisfaction and perceived naturalness, measured inconsistently across studies. Finally, many studies lacked standardized volumetric or imaging-based evaluation, which may influence the reliability of reported effect sizes.

Future Research: Future studies should prioritize standardized reporting of injection depth, filler type, anatomical site, and outcome metrics. High quality randomized controlled trials comparing superficial, subcutaneous, and deep injections within specific facial regions warranted. Incorporation of objective imaging methods, such as 3D volumetric analysis and ultrasound-guided assessment, can enhance accuracy and reproducibility. Long-term studies evaluating durability and late adverse events needed, particularly for bio stimulatory fillers like PLLA and CaHA. Additionally, integration of patient-reported outcomes, including satisfaction, psychosocial impact, and aesthetic perception, will provide a more holistic understanding of depth-dependent efficacy. These efforts will support evidence-based guidelines, improve clinical decision-making, and optimize both safety and aesthetic outcomes in facial filler practice

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Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

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