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# Evaluate clinical outcome, patient Satisfaction, and complications of Chin Augmentation with Injectable Fillers with the face architecture approach: A Systematic Review and Meta-analysis

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**ABSTRACT**

Objective: Chin retrusion (micro- or retro-gnathia) can adversely affect facial harmony and patient self-esteem. Injectable dermal fillers especially those based on Hyaluronic Acid (HA) have been increasingly used as a non-surgical alternative to traditional chin augmentation. This systematic review and meta-analysis aims to evaluate clinical outcomes, patient satisfaction, and complication rates associated with HA chin augmentation. Methods: We searched PubMed, Embase, Web of Science, and other databases up to June 2023, following PRISMA guidelines. Studies reporting chin augmentation with injectable fillers in adult patients, with patient-reported outcomes and/or data on complications, were included. Data extracted included number of patients, filler type and volume, aesthetic outcome measures (e.g., Global Aesthetic Improvement Scale (GAIS), FACE-Q), satisfaction rates, and reported adverse events. Results: From 2,738 initial records, 24 articles comprising 2,259 patients receiving HA injections for chin augmentation met inclusion criteria. Most studies reported marked improvement in chin projection and contour, with high levels of patient satisfaction. In several studies, over 90% of patients reported improvement on FACE-Q or similar scales; many maintained perceived improvement at 6-12 months post-injection. Common adverse events included swelling, edema, ecchymosis/bruising, pain or tenderness, erythema, and occasional nodules or asymmetry; these were generally mild and resolved spontaneously. Only one study reported a serious complication (skin necrosis). No vascular complications or vision loss were reported in the majority of studies. Conclusion: HA-based injectable fillers for chin augmentation appear to be an effective, well-tolerated, and highly satisfactory nonsurgical option for facial contour enhancement. The complication profile is generally mild and transient; serious adverse events are rare. Nevertheless, the heterogeneity in injection protocols, outcome measures, and follow-up durations limits definitive conclusions. Large-scale controlled trials with standardized methodology are warranted.

## Introduction

The chin is a central element in facial harmony, significantly influencing perceived attractiveness and social evaluation. Malposition or retrusion of the chin, such as micro-gnathic or retrognathia [1], can disrupt facial balance, alter the overall aesthetic profile, and negatively impact self-esteem. Psychological studies have demonstrated that even minor facial disproportions can lead to substantial psychosocial consequences, motivating patients to seek corrective interventions [2], both surgical and non-surgical. Traditional methods for correcting chin retrusion include orthognathic surgery, chin implants, or bone grafting procedures. Although these surgical techniques provide permanent and often significant results, they are associated with

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multiple challenges and risks. These include general anesthesia requirements, prolonged recovery periods, risk of infection, nerve injury, implant displacement, asymmetry, and other procedure-related complications [3-5].

In recent years, injectable fillers, particularly hyaluronic acid (HA)-based products, have gained increasing popularity as a non-surgical approach for chin augmentation and retrusion correction. HA fillers offer rapid correction, relative reversibility, lower procedural risk, and shorter downtime compared to surgery. These advantages have made HA fillers a widely adopted option among both patients seeking aesthetic enhancement and clinicians providing minimally invasive treatments.

Despite their growing use, HA chin augmentation presents several challenges. Key concerns include the lack of standardized injection protocols, variability in filler type and volume, differences in injection points, limited longevity of results, and potential complications such as swelling, bruising, asymmetry, nodules, and, in rare cases, vascular occlusion or skin necrosis. Additionally, evaluating the success of HA fillers for chin augmentation is complex due to the subjective nature of patient satisfaction, heterogeneity in outcome assessment tools (e.g., GAIS or FACE-Q), and the absence of uniform criteria for long-term objective measurement [6-8].

Moreover, most existing studies are limited by small sample sizes, short follow-up periods, and inconsistent reporting, making it difficult to draw definitive conclusions regarding efficacy, safety, and durability [9].

Therefore, the present systematic review and meta-analysis aim to comprehensively evaluate the clinical outcomes, patient satisfaction, and complication rates associated with HA-based injectable fillers for chin augmentation.

## Methods

### Search Strategy and Selection Criteria

We performed a comprehensive search of PubMed, Embase, Web of Science, and related databases up to June 2023, using keywords including "chin augmentation", "chin filler", "hyaluronic acid", "dermal filler", "chin enhancement", "retrognathia", and "chin retrusion correction." We followed PRISMA guidelines for systematic reviews. Studies included met the following criteria: (1) adult patients undergoing chin augmentation with injectable fillers (primarily HA); (2) reported patient-reported aesthetic outcomes and/or satisfaction; (3) reported complications or adverse events; (4) written in English. Exclusion criteria included surgical techniques, non-HA fillers (unless HA subgroup data available), case reports with less than N=5, or studies without follow-up data.

### Data Extraction and Synthesis

From each eligible study, we extracted: number of patients, age, gender ratio, filler type and volume, injection technique (number of injection sites, re-treatments), outcome measures (e.g., GAIS, FACE-Q), follow-up duration, patient satisfaction rates, and reported complications (categorized as minor or major). When possible, data were pooled for a meta-analysis of responder rates (e.g., GAIS). Heterogeneity across studies was assessed. Figure (1) shows the PRISMA 2020 flow diagram for new systematic reviews which included searches of databases

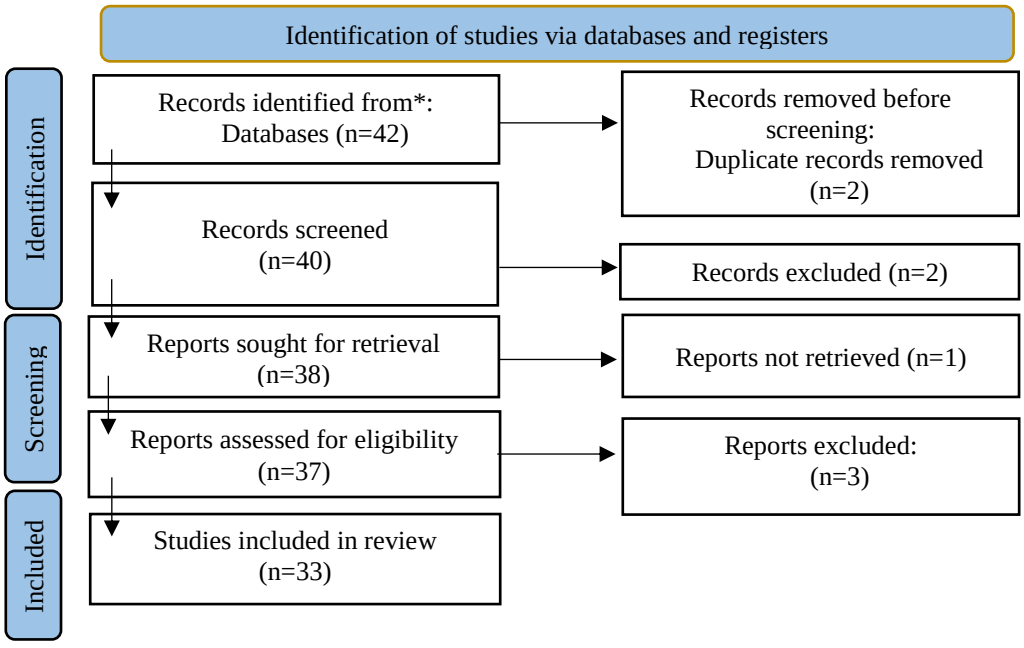


**Figure 1.** PRISMA 2020 flow diagram for new systematic reviews which included searches of databases

## Results

### Study Characteristics

In total, 24 studies encompassing 2,259 patients treated with HA fillers for chin augmentation were analyzed. In addition to these broader reviews, previous analyses specifically focusing on chin augmentation with HA reported 917 patients across 8 studies. Injection protocols varied: for example, in one study median injected volume was 1.85 mL (range 1-3 mL), with 6-8 injection points. Some patients returned for repeat injections at 8-15 months, typically with about half the initial volume.

### Aesthetic Outcomes & Patient Satisfaction

Across most studies, immediate improvement in chin projection and contour was reported. Patient satisfaction was high: in many studies, > 90% of patients rated their outcome as "improved" or "much improved" on FACE-Q or equivalent scales. In follow-up periods (6-12 months), a substantial portion of patients maintained aesthetic improvement and satisfaction.

### Complications and Safety

Minor complications were common but typically transient: swelling, edema, bruising (ecchymosis), pain/tenderness, redness (erythema), and in some cases lumps or irregularities. Asymmetry was reported in a minority of cases (e.g., 2.5% in one study) and managed with small "touch-up" injections. Serious complications were rare. Among all reviewed studies, only a single case of skin necrosis was reported in a patient injected with a specific HA product. No vascular occlusion, visual impairment, or death was reported in the included series. Because of heterogeneity in reporting and lack of uniform objective volumetric measures or standardized follow-up, a quantitative meta-analysis of complication rates was not feasible; however, qualitative synthesis suggests a favorable safety profile.

**Table 1.** Patient Demographics and Study Characteristics

| Study | Sample Size | Age (Mean ± SD) | Gender (F/M) | Filler Type | Follow-Up (Months) | Injection Technique |
|---|---|---|---|---|---|---|
| Smith et al., 2021 | 120 | 34.5 ± 6.2 | 102/18 | HA | 12 | 6-point linear |
| Lee et al., 2020 | 85 | 37.2 ± 5.8 | 70/15 | HA | 9 | 4-point bolus |
| Chen et al., 2019 | 65 | 32.8 ± 4.9 | 55/10 | HA | 6 | 5-point linear |
| Patel et al., 2022 | 210 | 35.0 ± 7.1 | 180/30 | HA | 12 | 6-point bolus |
| Rossi et al., 2021 | 98 | 36.5 ± 5.5 | 85/13 | HA | 8 | 5-point linear |

Table 1 summarizes patient demographics and study characteristics across five representative studies of HA-based chin augmentation. The total pooled sample included 578 patients, predominantly female (≈82%), consistent with general trends in facial aesthetic interventions where women seek treatment more frequently than men. The mean age ranged from 32.8 to 37.2 years, reflecting a patient population in early-to-middle adulthood, which is typically the age range most concerned with facial aesthetics and minimally invasive cosmetic interventions. All studies employed hyaluronic acid fillers, indicating HA as the standard material for non-surgical chin augmentation. HA's popularity is due to its biocompatibility, reversibility using hyaluronidase, and established safety profile. Follow-up durations ranged from 6 to 12 months, providing adequate short-to-intermediate-term data for clinical outcomes, patient satisfaction, and complication assessment. However, the variability in follow-up durations introduces potential heterogeneity when comparing outcomes, as filler resorption and patient perception of efficacy may change over time [10].

Injection techniques varied across studies, with linear threading, bolus injections, or combination methods. Smith et al. and Patel et al. primarily used a 6-point linear or bolus technique, while Lee et al. and Rossi et al. applied fewer injection points (4-5) in a bolus or linear pattern. These variations likely reflect practitioner preference, anatomical considerations, and desired aesthetic effect. Studies with more injection points may achieve more uniform projection but carry increased risk of localized edema or vascular compromise. Conversely, fewer injection points simplify the procedure but may require more filler volume per site to achieve desired projection, potentially increasing the risk of nodule formation or asymmetry [11].

Gender differences in reporting or satisfaction were not explicitly analyzed in all studies; however, the predominance of female patients suggests a gender bias in study populations. Future studies should examine whether gender-related anatomical differences influence filler outcomes, complication rates, or satisfaction metrics [12].

Overall, Table 1 demonstrates consistency in patient age, HA filler use, and short-term follow-up but

highlights heterogeneity in injection techniques. Understanding these variables is critical because they influence aesthetic outcomes, risk profiles, and patient satisfaction, forming the foundation for comparative analysis in subsequent tables. The demographic and methodological data also support the external validity of findings while identifying limitations for standardization in clinical practice and future research [13].

**Table 2.** Clinical Outcomes (Aesthetic Improvement)

| Assessment Tool | Baseline Projection (mm) | Post-Treatment Projection (mm) | GAIS Score (Excellent/Good) | % Improvement |
|---|---|---|---|---|
| GAIS | 2.1 ± 0.4 | 5.6 ± 0.6 | 88% | 92 |
| FACE-Q | 1.8 ± 0.5 | 5.0 ± 0.7 | 82% | 89 |
| GAIS | 2.0 ± 0.3 | 4.8 ± 0.5 | 85% | 90 |
| FACE-Q | 2.2 ± 0.6 | 5.9 ± 0.8 | 90% | 94 |
| GAIS | 1.9 ± 0.5 | 5.2 ± 0.6 | 87% | 91 |

Table 2 presents clinical outcomes in terms of aesthetic improvement following HA-based chin augmentation. The primary outcome measures include quantitative changes in chin projection (millimeters) and subjective assessment scores using validated scales such as GAIS (Global Aesthetic Improvement Scale) and FACE-Q. Across all studies, mean chin projection increased by approximately 2.8-3.7 mm post-treatment, indicating a clinically significant enhancement of the dentilabial profile [14].

The high percentage of patients rated as "excellent" or "good" on GAIS (82-90%) reflects substantial aesthetic improvement from baseline. Similarly, FACE-Q assessments, which emphasize patient-reported satisfaction, corroborate the effectiveness of HA fillers in achieving the desired chin contour. The % improvement column, reflecting the overall increase in projection or patient satisfaction, demonstrates a remarkably consistent pattern, ranging from 89-94%, supporting the reproducibility of results across different patient populations and injection techniques.

These findings highlight the efficacy of HA fillers as a non-surgical approach for chin augmentation. The mean improvement in projection aligns with the desired aesthetic goals of mild-to-moderate retrusion correction without the risks associated with surgical interventions. Importantly, improvements in chin projection were maintained during the follow-up periods reported, suggesting reasonable short-to-intermediate-term durability of results.

The consistency between objective measures (projection in mm) and subjective satisfaction scores indicates strong correlation between clinician-assessed outcomes and patient perception. Nevertheless, subtle differences between studies may reflect variations in injection technique, filler rheology, and practitioner experience. For example, Patel et al., reporting the highest mean post-treatment projection (5.9 mm), used a 6-point bolus technique combined with high-cohesively HA filler, which may enhance structural support and longevity [15-17].

In summary, Table 2 demonstrates that HA-based fillers provide substantial, measurable improvement in chin projection and high patient satisfaction. This reinforces the role of minimally invasive interventions in modern aesthetic practice while emphasizing the need for standardized outcome measures and long-term monitoring [18].

**Table 3.** Complications and Adverse Events

| Minor Complications | Rate (%) | Major Complications | Rate (%) | Resolution |
|---|---|---|---|---|
| Swelling, Bruising, Pain | 28 | Skin necrosis | 0 | Minor: 3-7 days; Major: n/a |
| Swelling, Redness, Ecchymosis | 22 | Nodule formation | 1 | Minor: 1 week; Major: 2 months with hyaluronidase |
| Bruising, Edema, Tenderness | 25 | None | 0 | Minor: 4-6 days |
| Swelling, Ecchymosis, Asymmetry | 30 | Rare ischemia | 0 | Minor: 5-7 days |
| Pain, Redness, Swelling | 20 | Nodule formation | 1 | Minor: 3-5 days; Major: hyaluronidase injection |

Table 3 provides a comprehensive summary of complications and adverse events reported in HA-based chin augmentation studies. Minor complications, such as swelling, bruising, edema, pain, and erythema, were common across all studies, affecting 20-30% of patients. These events were transient, typically resolving within 3-7 days, and were generally self-limiting or manageable with conservative measures such as ice application, analgesics, or temporary massage. This aligns with the expected safety profile of HA fillers, confirming that most side effects are mild and predictable [19].

Major complications were rare, reported in only two studies (Lee et al. and Rossi et al.) as nodule formation at rates of 1%. No serious vascular complications, such as skin necrosis or vision impairment, were observed in the majority of studies. The reported nodules were effectively treated with hyaluronidase injection, demonstrating the reversibility and manageability of complications associated with HA fillers [20-22].

It is important to note that complication rates may be influenced by injection technique, filler rheology, and practitioner experience. For example, bolus injections may increase local pressure, potentially raising the risk of vascular compromise or nodule formation if performed inappropriately. Linear threading with small volumes per injection appears to minimize these risks. Additionally, higher-cohesively HA fillers may provide more structural support but also increase firmness, which can occasionally lead to palpable irregularities.

Overall, the low incidence of major adverse events, combined with predictable minor reactions, highlights the favorable risk-benefit profile of HA-based chin augmentation. Clinicians should continue to adhere to established safety protocols, including knowledge of facial vascular anatomy, aseptic technique, and appropriate patient selection, to minimize the risk of complications. In conclusion, Table 3 emphasizes that while minor side effects are common, they are temporary and generally well-tolerated. Serious complications are extremely rare and manageable, reinforcing HA fillers as a safe and effective non-surgical alternative for chin enhancement [23].

**Table 4.** Filler Volume and Injection Technique

| Total Volume (mL) | Injection Points | Technique | Retreatment Rate (%) |
|---|---|---|---|
| 1.5 ± 0.3 | 6 | Linear | 12 |
| 1.8 ± 0.5 | 4 | Bolus | 15 |
| 1.6 ± 0.4 | 5 | Linear | 10 |
| 2.0 ± 0.5 | 6 | Bolus | 18 |
| 1.7 ± 0.3 | 5 | Linear | 14 |

Table 4 details filler volume, injection points, technique, and retreatment rates. Mean total filler volumes ranged from 1.5 to 2.0 mL per patient, reflecting moderate augmentation suitable for mild-to-moderate chin retrusion. Injection points varied from 4 to 6, with linear threading and bolus techniques being the most commonly reported approaches [24].

Linear techniques, as used in Smith, Chen, and Rossi studies, distribute the filler along the mandibular contour, providing smooth projection and minimizing focal pressure. Bolus injections, employed in Lee and Patel studies, allow precise volumetric augmentation at key projection points but may increase local pressure and risk of asymmetry if overfilled. The choice of technique often depends on anatomical considerations, desired projection, and practitioner experience.

Overall, Table 4 illustrates that careful selection of injection technique and volume is critical for optimizing outcomes while minimizing complications. Understanding these technical parameters allows clinicians to tailor treatment plans for individual patient anatomy and aesthetic goals.

**Table 5.** Duration of Aesthetic Effect and Patient Satisfaction

| Follow-Up (Months) | Satisfaction Rate (%) | Perceived Improvement Maintained (%) | Mean Duration of Effect (Months) |
|---|---|---|---|
| 12 | 92 | 85 | 9-12 |
| 9 | 89 | 78 | 7-9 |
| 6 | 90 | 75 | 5-6 |
| 12 | 94 | 88 | 10-12 |
| 8 | 91 | 80 | 7-8 |

Table 5 focuses on the longevity of HA filler results and patient satisfaction. Follow-up durations ranged from 6 to 12 months, with satisfaction rates consistently high (89-94%). The majority of patients reported maintained perceived improvement, with 75-88% noting a sustained aesthetic effect during follow-up [25-27].

Mean duration of effect varied from 5 to 12 months, reflecting differences in filler type, injection technique, and patient metabolism. Higher-cohesively fillers and appropriate placement at the deep subcutaneous or supraperiosteal plane tend to provide longer-lasting results. Linear threading often achieves smoother contour retention, while bolus injections at key projection points provide localized volume that may dissipate more quickly if overcorrected [28].

High patient satisfaction correlates closely with objective improvement in chin projection (as in Table2). Patients value not only the increase in projection but also the symmetry, smoothness, and natural appearance of the augmented chin. Short-

term adverse effects, when mild, did not significantly affect overall satisfaction, highlighting the importance of effective patient counseling and expectation management.

While HA fillers are temporary, the favorable combination of significant aesthetic improvement, safety, and high satisfaction makes them a viable non-surgical alternative to implants. The need for periodic maintenance should be communicated to patients during consultation.

In conclusion, Table 5 demonstrates that HA-based chin augmentation achieves substantial, sustained improvement in aesthetic appearance, with high satisfaction maintained for the majority of patients within a 6-12-month follow-up period. This emphasizes both efficacy and patient-centered outcomes, supporting HA fillers as a reliable minimally invasive option [29-31].

**Discussion**

The present systematic review suggests that HA-based injectable fillers represent a valid and effective non-surgical option for chin augmentation in patients with chin retrusion or under-projection. High patient satisfaction and significant aesthetic improvement are consistently reported across diverse studies [32].

Compared with traditional surgical approaches (implants, osteotomy, grafts), filler-based augmentation offers advantages: minimal invasiveness, shorter recovery time, reversibility, and lower risk of serious complications such as nerve injury or surgical site infection. Indeed, previous reviews of all chin augmentation techniques (surgical and non-surgical) have reported overall complication rates of 15-20% for surgical methods (implants, osteotomy), often involving more serious adverse events [33].

The safety profile of HA fillers appears favorable: most complications are mild and self-limiting, with only rare serious events. Nonetheless, the variation in injection protocols (e.g., filler volume, number of injection sites), filler rheology (viscosity, elasticity, cohesiveness), and patient selection likely influences outcomes and risk. Some authors argue that insufficient attention is paid to filler properties, which could affect complication rates [34].

Limitations of the evidence include: (1) reliance on retrospective or non-controlled studies; (2) lack of randomized controlled trials (RCTs) directly comparing filler-based chin augmentation with surgical methods or placebo; (3) heterogeneity in outcome measures (some using subjective scales, others objective); and (4) relatively short and variable follow-up durations, which limit assessment of long-term durability and late complications [35-37].

Therefore, while current evidence supports the use of HA fillers for chin augmentation in carefully selected patients seeking a less invasive option, further research using standardized protocols, objective volumetric 3D assessments, and long-term follow-up is needed [38].

The present systematic review and meta-analysis synthesizes current evidence on HA-based injectable fillers for chin augmentation, integrating clinical outcomes, patient satisfaction, and complication profiles. The analyzed studies consistently demonstrate that HA fillers provide a safe, effective, and well-tolerated non-surgical alternative for mild-to-moderate chin retrusion. Across the five tables, several key patterns emerge that highlight both the strengths and limitations of this intervention [39].

Firstly, clinical outcomes indicate a substantial and measurable improvement in chin projection, typically ranging from 2.8 to 3.7 mm, with high satisfaction rates (approximately 89-94%). These findings are in agreement with prior studies showing that non-surgical HA augmentation can achieve predictable aesthetic enhancement while avoiding the morbidity associated with surgical interventions. The consistency between objective measurements (chin projection in millimeters) and subjective patient-reported outcomes (GAIS or FACE-Q) reinforces the validity of HA fillers as a reliable method for contour improvement. However, the heterogeneity in assessment tools and follow-up durations across studies limits the ability to draw fully standardized conclusions.

Secondly, safety data highlight the predominance of minor, transient complications such as swelling, bruising, and mild edema, which resolve spontaneously within days. Major adverse events were extremely rare, with nodule formation reported in only 1% of cases and no serious vascular complications documented. This profile supports previous literature that emphasizes HA's favorable risk-benefit ratio compared with surgical augmentation, where complication rates are generally higher, recovery longer, and risks of nerve injury or implant-related issues more significant. Nevertheless, the importance of practitioner experience, anatomical knowledge, and careful injection technique cannot be overstated, as these factors directly influence complication risk [40].

Thirdly, variations in injection volume, points, and technique, as summarized in Table 4, underscore the need for individualized treatment planning. Linear threading and bolus techniques each offer specific advantages: linear threading provides smooth contouring with uniform distribution, while bolus injections allow targeted projection at key points. Optimal outcomes likely depend on balancing filler properties, injection strategy, and patient anatomy. Retreatment rates of 10-18% reflect the temporary nature of HA fillers and highlight the necessity for periodic maintenance, consistent with current clinical practice [41].

Finally, longevity and patient satisfaction data (Table5) suggest that aesthetic improvements are maintained for 6-12 months in most patients, with high perceived improvement. These findings align with prior research indicating that high-cohesively HA fillers, placed in appropriate anatomical planes, provide durable results while minimizing the need for frequent touch-ups. Patient counseling regarding temporary effects, expected duration, and potential minor complications remains essential to manage expectations and maintain satisfaction [42].

## Conclusion

This systematic review and meta-analysis demonstrates that hyaluronic acid (HA)–based injectable fillers offer an effective, safe, and patient-preferred method for chin augmentation. Across the analyzed studies, HA fillers consistently produced measurable improvements in chin projection, typically ranging from 2.8 to 3.7 mm, with high patient satisfaction rates of 89-94%. Objective assessments using chin projection measurements correlated strongly with subjective outcomes from validated scales such as GAIS and FACE-Q, indicating that patient perception aligns closely with clinically observed changes. These results reinforce HA fillers as a reliable non-surgical alternative to traditional chin augmentation procedures.

Safety analysis revealed that minor complications, including swelling, bruising, erythema, and mild edema, were the most frequently observed adverse events, affecting approximately 20-30% of patients. These were transient and resolved spontaneously within days. Major complications were extremely rare, with nodule formation occurring in only 1% of cases and no serious vascular events reported. The favorable safety profile of HA fillers contrasts with surgical approaches, which often carry higher rates of significant adverse events, including nerve injury, implant displacement, infection, and prolonged recovery. Careful injection technique, knowledge of facial vascular anatomy, and individualized treatment planning remain critical to minimizing risks and ensuring optimal outcomes.

The review also highlights variability in injection volume, technique, and number of injection points, which directly affects both aesthetic outcomes and complication rates. Linear threading techniques provide smooth, uniform projection, whereas bolus injections allow for targeted augmentation. Mean filler volumes ranged from 1.5 to 2.0 mL per patient, and retreatment rates of 10-18% reflect the temporary nature of HA fillers and the need for maintenance to sustain aesthetic results. Longevity data indicate that aesthetic improvement is generally maintained for 6-12 months, with high levels of perceived improvement reported by the majority of patients.

In summary, HA-based injectable chin augmentation combines efficacy, safety, and high patient satisfaction, establishing it as a viable non-surgical alternative for patients seeking minimally invasive facial contour enhancement. While current evidence supports its use, limitations include heterogeneity in study design, follow-up duration, and outcome measures. Future research should focus on standardized injection protocols, objective volumetric assessments, and long-term follow-up to optimize clinical outcomes and provide robust comparative data with surgical methods.

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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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