

# Comparison of the Impact of Chin Augmentation Treatments by Genioplasty versus Hyaluronic Acid Filler Injection on Facial Attractiveness of Patients with Mild to Moderate Microgenia

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## Article History

Received: 9 September 2023

Accepted: 23 October 2023

## Abstract

**Background and Aim:** Sliding genioplasty is employed to correct a broad spectrum of chin abnormalities, encompassing horizontal and vertical augmentation and horizontal and vertical reduction. Injectable soft tissue fillers offer a less invasive alternative to genioplasty. This study aimed to compare the esthetic outcomes of chin augmentation using the abovementioned two methods.

**Materials and Methods:** This comparative interventional study enrolled 36 patients with mild to moderate microgenia presenting to the Department of Oral Surgery, Faculty of Dentistry, Islamic Azad University of Medical Sciences. They were candidates for chin contour correction through sliding genioplasty or hyaluronic acid filler injection (n=18 in each group). Photographs were obtained before and 3 months after genioplasty surgery and 1 month after filler injection. Subsequently, the images were evaluated by 10 oral and maxillofacial surgeons, 10 orthodontists, and 20 laypersons, using a visual analog scale (VAS) to appraise facial attractiveness after treatment. Comparisons were made by independent t-test (alpha=0.05).

**Results:** Orthodontists and oral and maxillofacial surgeons found no significant difference between the two methods in terms of facial aesthetics post-procedure (P>0.05). However, laypersons gave higher esthetic scores to genioplasty (P=0.02).

**Conclusion:** Based on the present results, orthodontists and oral and maxillofacial surgeons did not identify any significant difference in facial attractiveness between sliding genioplasty and hyaluronic acid filler injection. However, laypersons tended to rate genioplasty more favorably.

**Keywords:** Genioplasty; Dermal Fillers; Chin; Cosmetic Techniques; Hyaluronic Acid

**Cite this article as:** Poorian B, Darehmi H, Jafari F, Samadzadeh S, Bani Asad N. Comparison of the Impact of Chin Augmentation Treatments by Genioplasty versus Hyaluronic Acid Filler Injection on Facial Attractiveness of Patients with Mild to Moderate Microgenia. *J Res Dent Maxillofac Sci.* 2024; 9(2):86-93.

## Introduction

Understanding, assessing, and addressing chin abnormalities can profoundly impact facial

esthetics. Achieving facial harmony entails addressing irregularities of the chin, mouth, lips, and nose. Comprehensive familiarity with the

available treatment modalities, including injectable fillers and genioplasty, is essential [1,2].

Sliding genioplasty emerges as a highly effective approach for reshaping of the chin [3]. The noteworthy advantages of this technique encompass patient contentment, meticulous and predictable soft tissue outcomes, surgical stability, and a relatively diminished likelihood of enduring complications post-procedure. Additionally, this methodology proficiently rectifies diverse chin irregularities encompassing horizontal and vertical augmentation, reduction in horizontal and vertical dimensions, correction of asymmetry, and contour refinement [4]. However, its inherent limitations include potential surgical complications, long recovery period as opposed to injectable fillers, requisites for an operating room and general anesthesia, and potential occurrence of hematoma, infection, lip ptosis, persistent paresthesia, and root damage [5].

Recent investigations indicate that injectable fillers are an astute remedy for the abovementioned concerns. Application of fillers, particularly novel hyaluronic acid products, is on the rise due to their ability to meet the variable expectations and requisites of surgeons and patients [6].

Injectable soft tissue fillers provide a minimally invasive alternative to genioplasty, presenting a pragmatic avenue for facial contouring and enhancement, accompanied by instantaneous results, and shorter recovery period and hospital stay compared to genioplasty [7]. The noteworthy advantages of fillers encompass simplified administration in contrast to surgery, not requiring an operating room, immediate results, no downtime, and not requiring suturing [5]. However, aside from the common complications such as edema, erythema, hypersensitivity, ecchymosis, filler displacement, and formation of nodules or irregularities, there exists the potential for more substantial complications like chin ptosis [8]. Furthermore, from a longitudinal standpoint, surgical genioplasty prevails as the optimal long-

term solution; whereas, injectable fillers represent a transient therapeutic modality necessitating recurrent interventions. Nonetheless, gel-based injectable fillers such as hyaluronic acid have demonstrated optimal efficacy for augmentation of facial components, boasting a commendable record of safety and effectiveness [9].

In a study by Hoenig [10] on patients who underwent genioplasty to address their chin hypoplasia, paresthesia of the mental nerve was observed to some degrees in nearly all patients. For those who had undergone genioplasty alone, the sensory function of the mental nerve was fully regained. The overall patient satisfaction level was notably high. In a study by Beer et al. [11], patients with microgenia received hyaluronic acid filler injections, which led to significant improvement of microgenia. Efficacy assessments employing the Global Aesthetic Improvement Scale indicated either enhancement or marked improvement in the outcomes. Also, Belmontesi et al. [12] reported successful administration of Restylane Sub-Q filler for esthetic enhancement of the chin.

Considering the knowledge gap concerning comparative therapeutic efficacy and esthetic outcomes of chin augmentation by filler injection versus genioplasty, a more lucid understanding of the cost-benefit dynamics of these approaches is imperative. Furthermore, in response to the escalating demand for esthetic chin interventions, this study aimed to compare the esthetic outcome of chin augmentation by the abovementioned techniques.

## Materials and Methods

The study protocol was approved by the ethics committee with the ethical code IR.IAU.DENTAL.REC.1401.081. This study was a retrospective comparative interventional study that included 36 patients presenting to the Oral and Maxillofacial Surgery Department of Tehran Islamic Azad University School of Dentistry complaining of microgenia. The patients eligible for study inclusion required chin augmentation

procedures utilizing either the sliding genioplasty technique or hyaluronic acid filler injection. Profile photographs of the patients were obtained both before and after the treatment. The type of treatment was selected according to the preferences of patients.

To evaluate chin deficiency, as the primary criterion for study inclusion and surgical planning, the Arnett Analysis was employed for clinical assessment. This assessment was performed in natural head position, with teeth in centric occlusion and lips in minimal contact with each other. Cephalometric measurements were made as part of the evaluation process. Accordingly, chin deformity was evaluated in the sagittal view, and chin position relative to the true vertical line (TVL) was assessed. The TVL was drawn from the subnasale point perpendicular to the Frankfurt horizontal plane. The distance from the soft tissue pogonion to the TVL line was measured. The standard distance from Pog' to TVL is  $-2.6 \pm 2.5$  mm in women, and  $-3.5 \pm 1.8$  mm in men. Any value exceeding these values would indicate microgenia [13]. Patients with a 7 mm value indicating mild to moderate microgenia were considered as potential candidates for chin augmentation and were included in the study. Patients requiring upper or lower jaw surgery due to chin deficiency, those with cleft lip and palate, developmental syndromes affecting the jaw and facial region, significant malocclusions, facial asymmetry, uncontrolled systemic conditions such as uncontrolled diabetes and malignancies, and immunodeficiencies were all excluded from the study. Furthermore, individuals with severe microgenia (chin deficiency exceeding 7 mm) or mandibular deficiency (B' to TVL distance surpassing the established norm) were not included; the standard range was  $5.3 \pm 1.5$  mm for women, and  $7.1 \pm 1.6$  mm for men. The patients were divided into two groups as follows:

**Group 1:** Eligible patients for sliding genioplasty: Surgical genioplasty treatment for patients with micrognathia was performed under aseptic and sterile conditions. Antibiotic prophylaxis was administered before the procedure. After temporarily fixing the upper and lower jaws in proper occlusion, a mucosal incision was made at 5-8 mm distance from the labial vestibule at an angle perpendicular to the surface. Subsequently, incisions were horizontally extended from one canine to the opposite canine, encompassing the alveolar process.

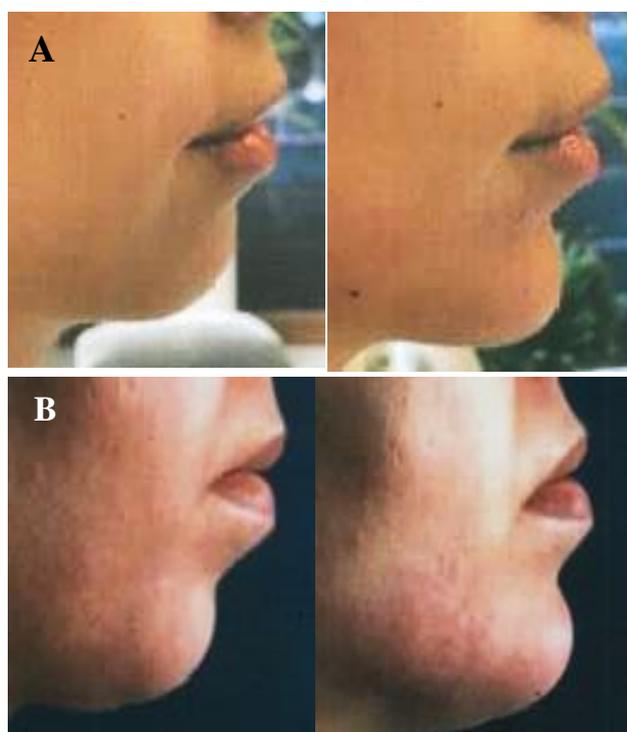
Subperiosteal dissection was carried out while preserving the mental nerve from the second premolar area to the opposite second premolar [10]. To execute the sliding genioplasty, a bone-cutting line was meticulously designed, maintaining a 5 mm distance from the roots of the incisor teeth.

A bony incision was meticulously crafted from the distal area of the second premolar to the contralateral second premolar using a surgical saw. This procedure, executed with precise alignment under direct visualization, protected the mental nerve and tooth roots. After completing the downward incision, the lower segment was advanced by approximately 5 mm and subsequently stabilized using a chin plate and four screws. Concluding the surgical steps, the mucosal incision was sutured in two muscular and mucosal layers, followed by application of an appropriate dressing to optimize patient care [10].

**Group 2:** Patients eligible for hyaluronic acid filler injection: Patients in this group underwent treatment in the lower third of the face using highly cohesive dermal fillers (Revofil 23 mg/mL HA; Caregen®, South Korea) and Prollenium (25 mg/mL HA; REVANESSE®, Canada). The main treatment areas included the chin, labiomental crease, and jawline.

For the apex of the chin, 0.5 to 1.5 mL of filler was injected close to the bone using a 13-mm 27G cannula (TSK Laboratory, Tochigi, Japan). For the labiomental crease, 0.3 to 0.7 mL of filler was injected into the superficial fat of the area using a 5-cm 25G cannula (TSK Laboratory, Tochigi, Japan). Similarly, 0.5 to 1.5 mL of filler was injected into the superficial fat of the jawline using a 5-cm 25G cannula [14].

Profile photographs were taken before and 3 months after treatment from patients eligible for genioplasty and 1 month after treatment for patients eligible for filler injection. In these photographs, the head was in natural position, and the lips were at rest [15] (Figure 1).



**Figure 1.** Before (left) and after (right) lateral photographs of two patients following (A) sliding genioplasty, and (B) hyaluronic acid filler injection

Before- and after-treatment photographs of patients were presented to 10 maxillofacial surgeons, 10 orthodontists, and 20 randomly selected laypeople. The laypeople had to be at least 17 years and had to have high school diploma. The raters spent 15 seconds per pair of images (before- and after-treatment images of

each patient) to rate their attractiveness using a visual analog scale (VAS) [16]. This scale was represented by a 100-mm discontinuous line, where 0 on the left end indicated "very unattractive," and 10 on the right end indicated "beautiful".

#### *Statistical analysis:*

Data analysis was carried out using SPSS version 19. Comparisons were made between the two groups by independent t-test. One-way ANOVA was applied to analyze the differences among more than three groups, followed by the Tukey post-hoc test for pairwise comparisons. Repeated measures ANOVA was used for within-group comparisons.  $P < 0.05$  was considered statistically significant.

## Results

Table 1 presents the esthetic scores given by different raters to the esthetic appearance of the chin in the two study groups. Orthodontists ( $P=0.745$ ) and oral and maxillofacial surgeons ( $P=0.117$ ) did not observe any significant difference between the two groups regarding attractiveness. However, the laypersons gave significantly higher esthetic scores to the genioplasty compared with filler injection group ( $P=0.024$ ).

## Discussion

The chin is a pivotal determinant of the facial appearance [2]. Microgenia, characterized by an underdeveloped chin, can impair a normal facial profile. Chin prominence significantly influences facial attractiveness, especially the facial profile and jawline [5]. This prominence is vital for harmonious facial features and satisfactory facial contours. Additionally, the prominence of the chin is interconnected with the nose prominence, ensuring balance in the sagittal facial view.

Various factors may be implicated in development of microgenia, including genetics, trauma, and aging [17].

**Table 1.** Esthetic scores given by different raters to the esthetic appearance of the chin in the two study groups

Rater group	Study group	Mean± std. deviation	95% confidence interval	P value
Orthodontists	Filler (n=18)	6.92 ±0.72	6.55 to 7.28	0.74
	Genioplasty (n=18)	6.83±0.76	6.45 to 7.20	
Oral and maxillofacial surgeons	Filler (n=18)	7.51±0.78	7.12 to 7.91	0.11
	Genioplasty (n=18)	7.89±0.61	7.58 to 8.42	
Laypersons	Filler (n=18)	7.05±0.48	6.81 to 7.31	0.02
	Genioplasty (n=18)	7.47±0.57	7.19 to 7.80	

Mandibular bone resorption and aging decrease the chin dimensions, substantially altering the facial appearance and increasing the cervico-mental angle. Furthermore, overbite and class II malocclusion are correlated with microgenia [3].

Studies on facial appearance underscore its influence on interpersonal interactions and individual self-esteem. Resultantly, the number of patients seeking surgical and minimally invasive non-surgical cosmetic procedures is on the rise [18-20]. Nonetheless, limited studies have juxtaposed individuals' perception of changes brought about by chin filler injections and genioplasty. This issue gains particular relevance when scrutinizing the perspectives of ordinary observers, as most existing studies have predominantly focused on surgeons or patients. In contrast, daily interactions mainly occur among individuals and their ordinary acquaintances.

The findings of the present study indicated that, from the standpoint of orthodontists and oral and maxillofacial surgeons, there was no significant disparity in esthetic outcomes between chin augmentation techniques by filler injection or genioplasty. However, laypersons gave higher scores to patients who underwent genioplasty than those opting for filler injection.

Beer et al. [11] examined the efficacy of hyaluronic acid filler (VYC-20L) injections for

patients with chin deficiency. They revealed that patients and external observers, unaware of the administered treatments, generally expressed satisfaction with the changes resulting from filler injections. Self-evaluation by patients, using the Global Aesthetic Improvement Scale (GAIS) scale, demonstrated that 87.3% of filler recipients perceived improvement or significant improvement in their appearance. According to the FACE-Q index, the average satisfaction scores increased by approximately 35.6 points in the filler group, with a corresponding decrease of about 3.3 points in the control group (without any therapeutic intervention). Moreover, calculations of psychological well-being scores based on the FACE-Q index indicated an increase of 15.4 points in the filler group and a decrease of 5.3 points in the control group. Furthermore, evaluations by external observers concurred with patient feedbacks. Among 125 external observers, 114 (91.2%) believed in significant improvements in treated patients; whereas, this percentage was approximately 19.5% in the control group.

Similar to the VYC-20L filler, a clinical trial investigating the therapeutic outcomes of utilizing the VYC-25L filler for chin augmentation exhibited substantial clinical benefits that persisted for 12 months. The average alteration from the baseline to the 12<sup>th</sup>

month in the glabella subnasale-pogonion angle amounted to 1.28 degrees. The GAIS scores at 12 months showed 83.5% agreement among raters and 77.2% among the participants. Additionally, the satisfaction module for the chin and the psychological well-being module of the FACE-Q index displayed a continuous enhancement in scores at 12 months compared to baseline, with values of 41.4 and 65.3, and 61.6 and 74.4, respectively [18].

Moreover, evaluation of the outcomes achieved through the injection of VYC-25L hyaluronic acid filler, as outlined in the study by Bertossi et al. [14] revealed that, based on the GAIS scale, a staggering 96.7% of the 30 patients perceived an improvement or significant improvement in their appearance. Gou et al. [21] revealed that hyaluronic acid injection could induce bone resorption in the mentum; nevertheless, esthetics was not impaired. The severity of bone loss was positively correlated with the injection volume per time; therefore, large-volume injection of hyaluronic acid should be performed with caution, and the patients should be fully informed about this complication preoperatively.

A comparative analysis of the therapeutic and esthetic results of rectifying chin deformities, conducted through genioplasty and alloplastic materials, as examined by Shirinbak and Basir Shabestari [22] unveiled that the postoperative satisfaction level of patients undergoing genioplasty and chin prosthetics did not exhibit significant differences. Regarding therapeutic complications, a higher likelihood of lip numbness and infection was observed in genioplasty and chin prosthesis cases. The present study further demonstrated no significant disparity between genioplasty and filler injection from the perspective of specialists and laypeople.

Jones and Vesely [23] reported that osseous genioplasty was the preferred technique

compared to alloplastic genioplasty. Their study underscored that when a surgical procedure is executed with precision, it can yield excellent esthetic outcomes, high levels of patient contentment, and long-term stability of the results while minimizing postoperative complications. Nevertheless, the current findings did not align with the conclusions drawn in their study. This inconsistency might be attributed to the exclusion of patients with severe microgenia and absence of a quantitative analysis of postoperative esthetic results, which are among the limitations of this study [23].

Considering the relative resemblance in esthetic outcomes of genioplasty and filler injection, the choice of an appropriate approach for modifying the appearance and dimensions of the chin hinges on several factors. These factors encompass patient preferences, proficiency of the clinician, and extent of chin deformity [2]. Uncomplicated horizontal microgenia can be corrected using any of the abovementioned methods. In chin asymmetry or deformities, osseous genioplasty or filler injection is more favorable than chin implant procedures. While filler injection constitutes a temporary means of chin augmentation, it boasts unparalleled adaptability in reshaping of the chin.

Genioplasty is an exceptional technique for adjusting the vertical length by shortening of the chin through osteotomy or increasing its height through intraosseous grafting. Moreover, genioplasty can be performed with other orthognathic surgeries if chin reshaping is part of the treatment plan.

Employing filler injection techniques permits horizontal chin augmentation, alteration of its vertical dimension, and even widening in the transverse dimension [2]. In patients with a deficiency in the horizontal dimension of the chin, surplus vertical chin height can be concealed using filler injections at the pogonion. Enhancing the paragonial region using injectable

fillers presents a significant advantage in comprehensive reshaping of the chin [2].

Khan et al. [24] reported temporary neurosensory discomfort of the inferior alveolar nerve as the most common complication that may occur after genioplasty. Careful preoperative planning, marking of the incision in soft tissue and bone markings with drills, minimal retraction of the nerve, and light dressing of the submental region can help prevent complications.

Another notable discovery from this study was that, in both the filler injection and genioplasty groups, the esthetic scores given by oral and maxillofacial surgeons were considerably higher than those assigned by orthodontists and laypeople. Additionally, in individuals who underwent genioplasty, the esthetic scores awarded by orthodontists were inferior to those given by laypeople. Conversely, in the filler injection group, the discrepancy in scores between the laypeople and orthodontists did not attain statistical significance.

## Conclusion

In the present study, the esthetic scores assigned by orthodontists and oral and maxillofacial surgeons did not show a significant difference between the filler injection and genioplasty groups. However, the laypersons rated genioplasty significantly higher in terms of esthetics compared to filler injection. Further research is required to evaluate the potential discrepancy in esthetic perception between professionals and the general public regarding these two procedures.

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