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Assessment of the Effect of Chin Augmentation with Hyaluronic Acid Filler on Facial Soft Tissues Using Lateral Cephalometric Radiograph

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Aim: To assess the effect of chin augmentation using Hyaluronic acid filler on facial soft tissues using lateral cephalometric radiographs.

Material and methods: Prospective case series. 10 adult female patients with mild chin deficiencies. Patients underwent chin augmentation using Restylane Defyne hyaluronic acid dermal filler. Each patient received 2ml Filler injected in the chin area. Lateral cephalometric radiographs were taken at three-time intervals for each patient. The first radiograph taken before augmentation procedure, second radiograph two weeks after filler injection and the third and final radiograph taken six months after the augmentation procedure. Two readings were used to assess the facial changes following the augmentation procedure and the stability of these changes after six months.

Results: Chin augmentation using Restylane Defyne showed marked improvement in sagittal position of soft tissue chin.

Conclusion: Hyaluronic acid dermal filler can be used effectively for correction of chin deficiency with stable results after six months.

Keywords: Chin augmentation, Hyaluronic acid filler, Lateral cephalometry

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Introduction

The treatments goals of orthodontics revolve around reaching the best possible functional and esthetic outcome for each patient¹. These goals often require adjunctive procedures in addition to conventional treatment. Czarnecki, Nanda and Currier (1993)², showed that balance between nose, lips and chin greatly contributes to the facial attractiveness of the profile and that a more prominent position of the chin can enhance profiles with more protrusive lips and nose as it acts to balance them out. Arnett and Bergman (1993)³ developed a method for assessment of chin deformity using a true vertical line passing through Subnasale point. Until recently, the gold standard for treatment of chin deficiency was surgical chin augmentation with or without placement of an implant⁴. This approach had many drawbacks relating to the invasiveness of the surgery with possibility of complications including nerve damage, root damage and looseness of the implant placed⁵. The use of dermal filler to either restore lost soft tissue volume or correct existing deficiencies have increased in popularity during the past decades with the development of new filler material and techniques⁶. In fact, Hyaluronic acid filler injection was the second most popular nonsurgical procedure in 2019 with hyaluronic acid constituting more than 92% of all dermal filler procedures^{7 8 9}. This high demand for this type of injectables can be attributed to their superior characteristics which include ease of administration, biocompatibility and good results¹⁰. *Restylane® Defyne* is a non-animal hyaluronic acid dermal filler produced by Galderma, which is an international dermatology company created in 1981¹¹. *Restylane® Defyne* is sterile, biodegradable, viscoelastic, non-pyrogenic, clear, colorless and homogenous, soft cross-linked hyaluronic acid gel. In February 2021 the FDA approved *Restylane® Defyne* for chin

augmentation in adults with mild to moderate chin retrusion after undergoing multiple clinical trials to support its safety and tolerability profile¹². Bertossi et al 2015¹³, created a protocol for classifying indications of possible treatment options of chin deficiency to improve treatment outcome and stability. It was concluded that for patients above 50 years, fillers were the ideal treatment choice for chin correction and for patients aged 30-50 years old patients may be treated by either filler or surgery while patients aged less than 30 years old were treated with either surgery or filler if sagittal chin deficiency was less than 4mm while surgery was ideal for larger discrepancies.

Materials and methods

A total of 10 participants were recruited from the outpatient clinic of the Orthodontic Department at the Faculty of Dentistry Ain Shams University. Inclusion criteria: Adult female patients with age ranging from 18 to 40 years who have undergone conventional orthodontic treatment and showed convex soft tissue facial profile as a result of mild to moderate chin deficiency. Exclusion criteria: Pregnant or lactating participants, Presence of facial scars or defects and Participants with craniofacial abnormalities or syndromes as well as any condition that would contraindicate the use of Hyaluronic acid dermal fillers. This study was approved by the Research Ethical Committee of Ain Shams University.

Procedure: An informed consent was signed by each patient before their enrollment in the current study in which the aim of the study and the methodology were clearly described. Case history was taken with assessment of patient's previous orthodontic records to evaluate chin deficiency. Full clinical examination of the facial soft tissues was performed including palpation of soft tissue overlying the bony chin to evaluate thickness as well as evaluation of the depth and height

of the mentolabial sulcus. Full patient records were obtained including a Lateral Cephalometric radiograph before the augmentation procedure. The skin over the chin area was sterilized then the area to be injected was anesthetized by topical anesthetic cream.



Fig. 1: Injection of filler

The proposed area for augmentation was clearly outlined on the face with the patient in upright position. The upper boundary should be at the desired height of the mentolabial sulcus and the inferior boundary at the lowest border of the chin. The lateral boundaries should correlate to the lateral desired extension of soft tissue chin. The resultant area should represent a semicircular area with filler to be placed in both the central Pogonion and lateral paragoinal region in order to improve overall chin shape and chin projection in profile view¹⁴. Injection of the highly viscoelastic Hyaluronic acid filler was done with the needle inserted to sufficient depth to bring the tip into direct contact with the underlying bone. Just before injection, the plunger rod was withdrawn slightly to aspirate and verify that needle tip is not inserted into a blood vessel.

The Restylane filler was slowly and evenly placed immediately above the periosteum

(fig. 1). Massaging was frequently done to ensure symmetry, natural tapering and avoid any nodules, contour irregularities and palpable lumps¹⁵. Patients were allowed to use an ice pack for a short time if any swelling arises. Patients were then instructed to avoid touching the treated area and to avoid application of any creams or cosmetics on the treated area until the skin has healed completely to avoid infections or any inflammatory response. They were also asked to avoid strenuous exercise, sun exposure or heat exposure during the first 24 hours to avoid any adverse effects such as temporary redness, swelling, and/or itching at treatment sites.

A lateral Cephalometric radiograph was taken with the patient in natural head position, with facial muscles relaxed at three points in time during this study, T0 (pre-treatment); T1 (2 weeks' post-treatment); and T2 (6 months' post-treatment). Then the radiograph was analyzed using Dolphin® Imaging software. Various hard tissue and soft tissue landmarks were identified and located¹⁶(Table 1, Table2).

| Landmark | Abbreviation | Definition |
|-----------------------------|--------------|---|
| Soft tissue Glabella | G' | Most anterior soft tissue point on the fronto-orbital soft tissue contour |
| Subnasale | Sn' | Point at which nasal septum merges mesially with the upper cutaneous lip in the midsagittal plane |
| Soft tissue Pogonion | Pog' | Most anterior point of the soft tissue chin |
| Soft tissue Gnathion | Gn' | Most inferior point on the soft tissue chin |
| Cervical point/throat point | C | Junction of the submental, submandibular regions and the neck in the midline |

| Sagittal Assessment | | |
|---------------------|---------------------------|-------------|
| 1 | Angle of facial convexity | G'-Sn'-Pog' |
| 2 | Lower face throat angle | Sn-Gn'-C |

Results

Two cephalometric readings were used to assess the changes in facial soft tissue following the augmentation

1. Angle of facial convexity:

There was a statistically significant difference in angle of facial convexity mean values at different follow-up periods

($P < 0.001$). T0 displayed significantly higher mean values, followed by T2, then T1. At T1, there was a significantly higher amount of decrease in angle of facial convexity compared to total decrease at T2. While, amount of relapse after 6 months was significantly lowest.

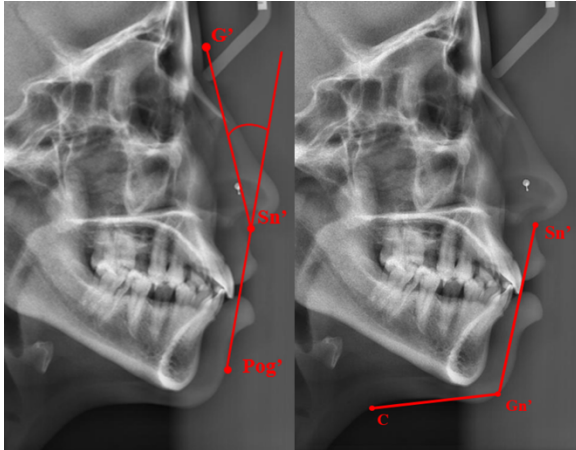


Fig. 2: Cephalometric readings

2. Lower face throat angle:

There was a statistically significant difference in lower face throat angle mean values at different follow-up periods ($P = 0.001$). T0 displayed significantly higher mean values, followed by T2, then T1. At T1, there was a significantly higher amount of decrease in lower face throat angle compared to amount of increase at 6 months. While, total decrease at T2 was significantly lowest.

| | T0 | T1 | T2 | Immediate change | Amount of relapse after 6 months | Change from baseline to T2 |
|---------------------------|--------------------------|--------------------------|-------------------------|-------------------------|----------------------------------|----------------------------|
| Angle of Facial Convexity | 20.96±3.97 ^a | 16.83±3.96 ^c | 18.11±3.49 ^b | -4.13±1.41 ^a | 1.28±1.10 ^b | -2.85±1.36 ^b |
| Lower face throat angle | 106.60±7.76 ^a | 102.20±6.81 ^c | 104.8±7.13 ^b | -4.40±2.17 ^a | 2.60±1.17 ^b | -1.80±1.31 ^c |
| P-value | <0.001* | | | <0.001* | | |

*: significant at $P \leq 0.05$

Means with different superscript letters are statistically significantly different at $P \leq 0.05$.

Discussion

This study aimed to evaluate the effect of chin augmentation using Hyaluronic acid dermal filler on facial soft tissues as well as stability of these changes after 6 months (Table 3). Two readings were used to assess these facial and the stability of these changes after six months (fig. 2). The results showed that the angle of facial convexity showed a significant decrease at T1 when compared to T0, this can be attributed to the forward movement of Pog' after filler placement. This change is similar to the decrease in convexity seen in advancement genioplasty as measured by Shaughnessy et al in 2006¹⁷. Our patients showed a mean decrease of 4.13° degrees which is comparable to the 6.6° by P. Sridhar Reddy et al.¹⁸ and Scheideman and Legan¹⁹ who showed a 2.7 degree decrease. This change showed low amount of relapse of mean value 1.28° at T2 which corresponds to 69% stability of the change in angle of facial convexity induced by the filler placed after 6 months' period.

The lower face throat angle showed a significant decrease at T1 of mean 4.4°. This is linked to the forward movement of soft tissues of the chin which in turn causes stretching of the soft tissue mask and upward lift of submental tissues. This can be clinically demonstrated by the reduction in the double chin appearance that normally increases with both aging and weight gain. This means that chin augmentation can be used to counteract the more pronounced aging effect in patients with mild chin retrusion. Although there was an increase in the angle after 6 months T2 of mean value 2.6°, however the total amount of increase was significantly less than the decrease at T1 thereby showing good amount of stability at T2.

Conclusions

1. The use of hyaluronic acid dermal filler can be used to correct increased facial convexity resulting from chin deficiency as well as improve the submental neck contour by improving chin prominence which stretches soft tissues and reduced lower face throat angle.
2. This result showed significant stability 6 months after augmentation procedure.

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