

Adult Facial Augmentation: Comparison of the Use of Hyaluronic Acid Injections and a Removable Orthodontic Device



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AUTHOR DISCLOSURE

Dr. Belfor is chairman and president of OrthoSmile™ Inc., which holds the patent for the Homeoblock™ appliance, the device discussed in this article. Dr. Belfor is the inventor and owner of the Homeoblock appliance.

ABSTRACT

This article compares the temporary facial enhancement that is achieved by injection of hyaluronic acid, to the enhancement that is provided by The Homeoblock™ functional removable orthodontic appliance (Space Maintainers Laboratory; Chatsworth, CA). Two case reports—one for each procedure type—are presented.

Today, injectable agents, specifically soft tissue fillers, represent the most commonly performed cosmetic procedures in the United States.

INTRODUCTION

NON-REMOVABLE APPLIANCES

In 1961, Haas stated that the Haas appliance increased nasal and maxillary width in 9- to 18-year-old subjects. Bishara and Staley compared the Haas, Minne, Hyrax, and Quad-Helix appliances, concluding that maxillary expansion resulted in increased nasal width with significant effects on the palatine lacrimal and zygomatic bones.¹ None of the aforementioned is a removable appliance and, despite the veracity of these findings, the soft tissue changes that might also occur have not been related to the underlying skeletal changes.²

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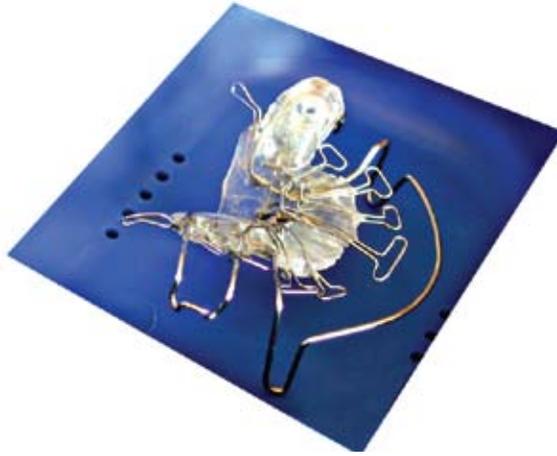


Figure 1: The Homeoblock™ Oral Appliance.

STEREO-PHOTOGRAMMETRY

In the cases presented here, a three-dimensional (3D) facial capture system (3dMDface System, 3dMD; Atlanta, GA) and stereo-photogrammetry were used to generate clinically accurate digital models of the patients' facial surfaces. This uses stereo-triangulation to identify external surface features viewed from stereo pairs of cameras. This technique projects a unique, random light pattern that is used as the foundation for triangulating the geometry in 3D. The capture takes less than 2 milliseconds per frame. The data are processed, creating a precise 3D point cloud digital model of the patient that is ready for immediate clinical use. Stereo-photogrammetry has been found to be "a suitable three-dimensional registration method for quantifying and detecting development changes in facial morphology."³

HYALURONIC ACID

There are a variety of non-surgical treatments for reducing facial lines and wrinkles, including botulinum toxin A, "wrinkle creams," chemical peels, and massage. "Hyaluronans, which have to a large extent replaced

collagen, both bovine and human, have become the most popular agents used for soft tissue augmentation in the entire facial area."⁴ The recommended technique involves a somewhat painful injection into the skin with a very fine needle. This may be done in one injection, or in a series of "beads" along the length of the area to be augmented. Today, injectable agents, specifically soft tissue fillers, "represent the most commonly performed cosmetic procedures in the United States."⁵

HOMEOBLOCK

The Homeoblock appliance (Fig 1), which enhances facial volume, can also reduce lines, wrinkles, and depressions, and produce a more youthful facial appearance. The device consists of Adams clasps on the second bicuspid, a palatal expansion screw and a Hawley labial bow from cuspid to cuspid, flap springs in contact with the incisors and bicuspid, and a unilateral bite block. Dr. Donald Enlow has said, "A capacity for facial remodeling in adults is retained throughout life."⁶ The Homeoblock is designed for adult facial and jaw development while straightening teeth, is

worn only at night, and can produce noticeable facial changes in adult patients in four to six months.⁷ Contraindications for use of the Homeoblock appliance are active gingival or periodontal disease, poor oral hygiene, or severely rotated or impacted teeth.

CASE REPORTS

CASE 1

A 43-year-old female presented for a consultation. She reported that she received hyaluronic acid injections from time to time to remove facial lines, wrinkles, and depressions. A 3D stereo-photogrammetric image was taken before this treatment and three to four weeks after the treatment (Fig 2). Surface texture and color were removed for comparison (Fig 3). Morphometric analysis was conducted to determine volumetric change. The red-to-orange color indicates a 1.3-mm increase in surface dimension around the eyes, lips, cheeks, and chin (Fig 4).

CASE 2

A 36-year-old female requested treatment to improve her smile. On examination it was found that the



Figure 2: Before and after facial enhancement with hyaluronic acid injections. The post-treatment image shows fuller lips and enhanced facial symmetry.

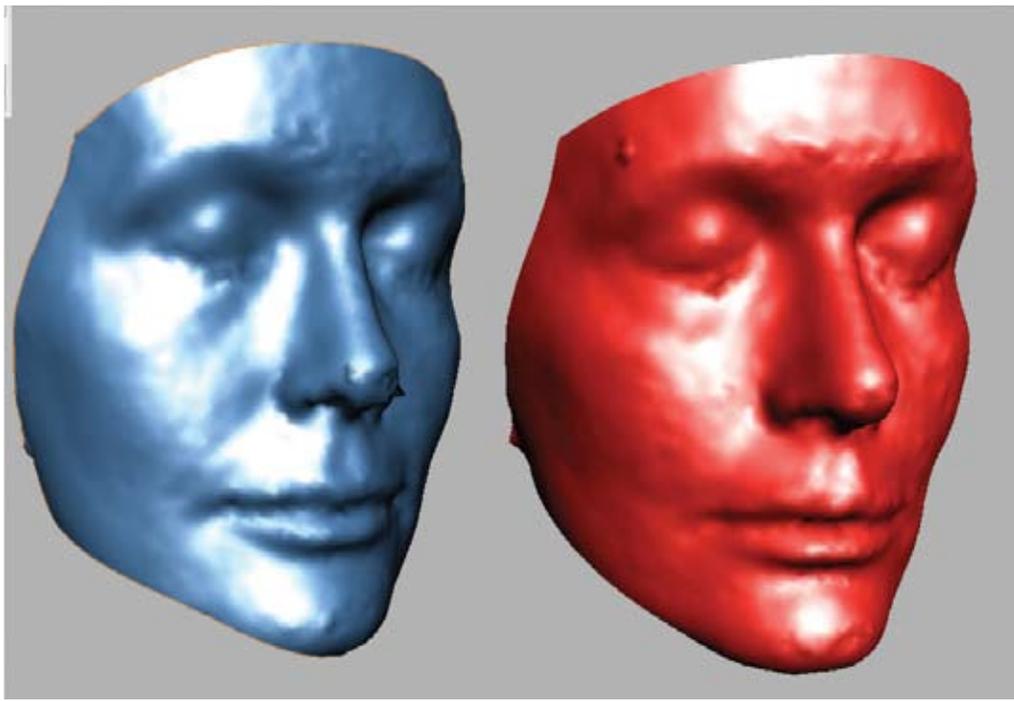


Figure 3: Post-treatment image shows reduced naso-labial depression.

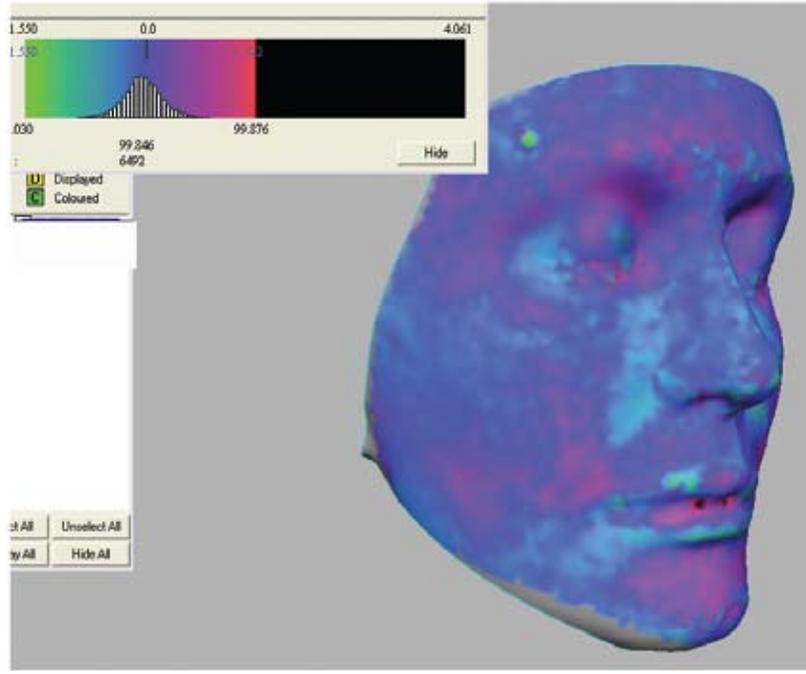


Figure 4: Morphometric analysis showing the increase in surface dimension around eyes, lips, cheeks, and chin.

upper arch was crowded. Three-dimensional facial stereo-photogrammetric images were taken. Impressions for study models were taken and Homeoblock appliances were fabricated (the patient was treated with upper and lower appliances to maintain the occlusal relationship).

The patient was instructed to wear the appliance every evening and throughout the night. Once a week, the expansion screw was advanced one full turn (0.25 mm). The patient reported for clinical adjustments and observation every three weeks; intraoral photographs were taken at each visit. The active treatment lasted 26 months, after which time a retainer was provided. During the course of treatment, intraoral photographs were taken (Figs 5 & 6). Nine months into treatment, a second 3D photograph was taken and assessed for morphometric changes

(Fig 7). Surface color and texture were removed for comparison (Fig 8). Morphometric evaluation for volume change was done (Fig 9). The results are the same regardless of age and gender (Fig 10).

The Homeoblock is designed for adult facial and jaw development while straightening teeth, is worn only at night, and can produce noticeable facial changes in adult patients in four to six months.

RESULTS

Facial changes were evident in both patients. Morphometric analysis indicated volumetric change, shown by the changes in surface dimensions. The surface dimension changes were comparable in both patients; however, the patient treat-

ed with the Homeoblock can expect very little if any reversal as long as she wears the appropriate retention. The patient treated with hyaluronic acid injections will need to redo the procedure in six months.

DISCUSSION

Although the Homeoblock appliance often is viewed as a simple palatal expansion device for adults similar to a hyrax appliance, it is unlikely that the semi-rapid expansion with the Homeoblock deploys the same physiologic mechanism in adults.

It is likely that the appliance induces a phenomenon more in line with the functional matrix hypothesis.⁸ The development of the hypothesis took a decade of study of the roles of intrinsic (genomic) and extrinsic (epigenetic) factors in ce-



Figure 5: Images 26 months after treatment show increased size of upper and lower alveolus and straighter teeth.



Figure 6: Before and after 12 months' treatment with the Homeoblock.

phalic growth. The functional matrix hypothesis stresses epigenetic primacy. Simply put, external forces (epigenetic) are more significant in the size, shape (e.g., form), and location of the maxilla than are genetic influences.

The unilateral bite block combined with the expansion screw of the Homeoblock provides a mechanical signal that is picked up by receptors around the teeth and around the bone. The mechanical signal is transformed into an electrical and chemical response that travels in the bone to the nucleus of a bone cell. The signal passes through

the membrane of the nucleus to the genome via "signal transduction," stimulating the expression of redundant genes or DNA alleles that start the process of bone development even in adults.

It is within the province and ability of the general dental practitioner to enhance midface volume and reduce maxillary retrusion using orthopedic orthodontic devices.

Moss states that "Static and dynamic loadings are continuously applied to bone tissue, lending to deform both extra-cellular matrix

and bone cells. When an appropriate stimulus parameter exceeds threshold values, the loaded tissue responds by the triad of bone cell (osteocyte, osteoblast, osteoclast) adaptation processes."⁸ Both osteocytes and osteoblasts are competent for intracellular stimulus reception, transduction, and subsequent intercellular signal transmission. In other words, the cell response can be "networked" from one osteocyte to another and then on to the osteoblasts. Osteoblasts indirectly regulate bone deposition and maintenance and directly regulate osteoclastic resorption.⁹

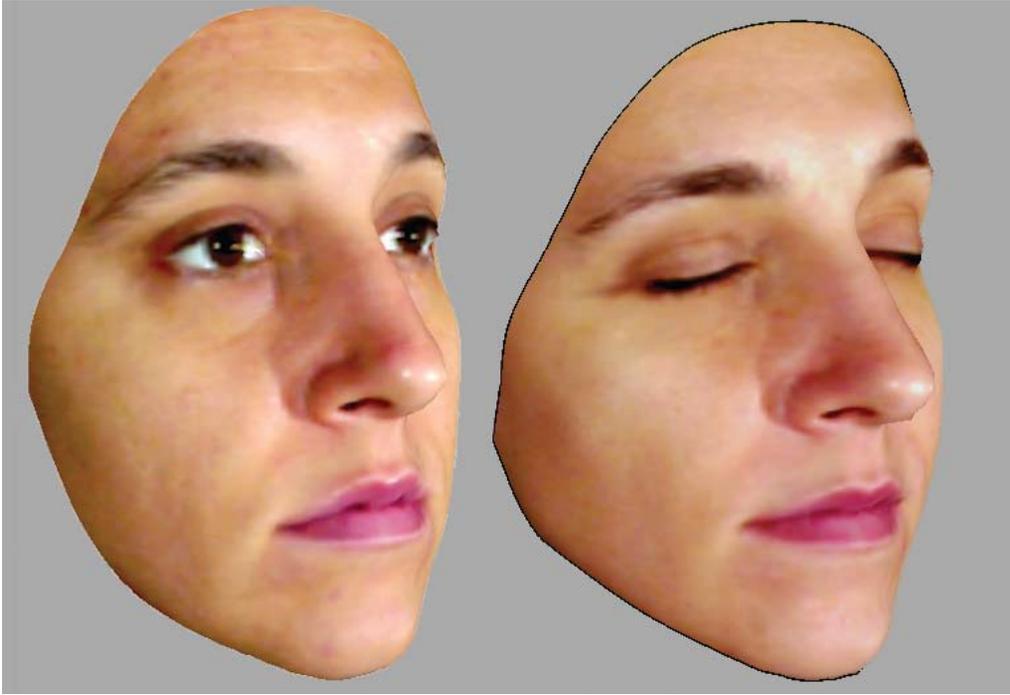


Figure 7: Before and after nine months' facial enhancement with the Homeoblock.

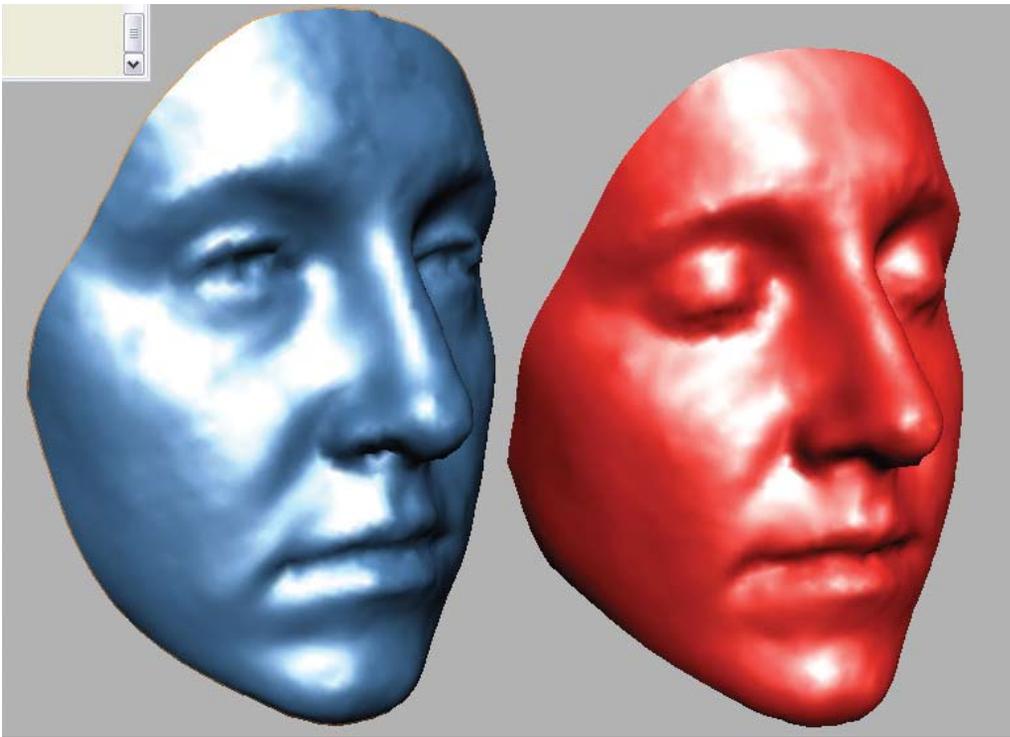


Figure 8: Surface color and texture removed. The post-treatment image shows a reduction in the naso-labial depression, a fuller upper lip, and less "pouching" at the corner of the mouth.

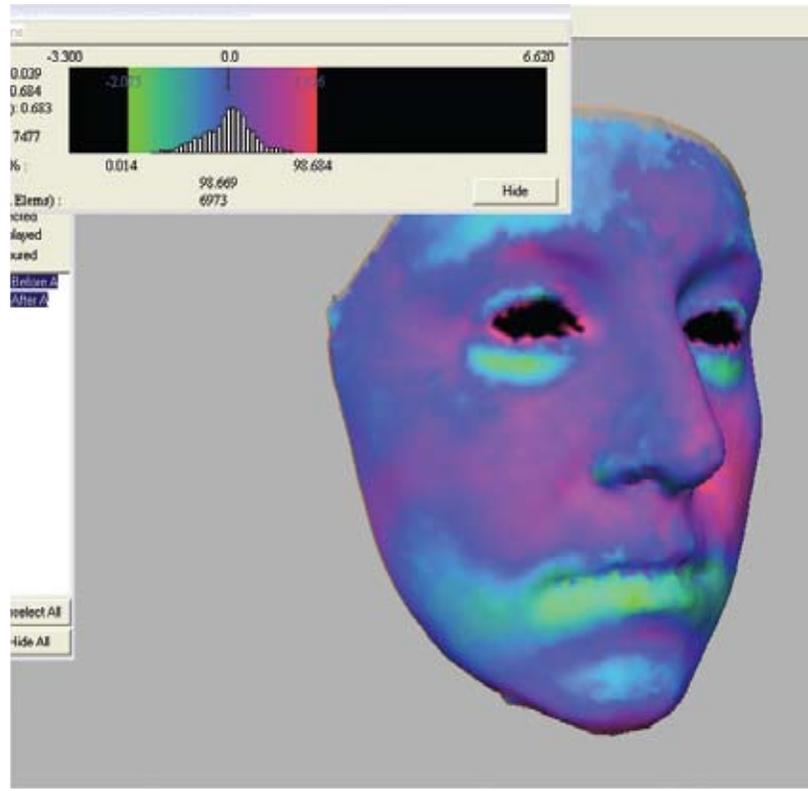


Figure 9: Morphometric evaluation. Red-to-orange color indicates an increase in surface dimension of 1.8 mm around the eyes, upper lip, and chin.

Osseous mechano-transduction is unique in that adaptational responses are confined in each bone organ independently. "This process translated the informational content of a periosteal functional matrix stimulus into a skeletal unit cell signal."⁸ It is suggested that the bite block induces a spatial change that invokes a biomolecular response that can activate the osteocytic genome.¹⁰

CONCLUSION

Maxillary retrusion combined with soft tissue changes are natural consequences of midface aging.¹¹ Cosmetic surgeons are limited in the ability to enhance the midface, as they cannot directly treat the chang-

es in the bone that are part of the aging process. There is great demand by patients to mitigate these effects. It is within the province and ability of the general dental practitioner to enhance midface volume and reduce maxillary retrusion using orthopedic orthodontic devices. This capability now positions the dental practitioner to work in a multidisciplinary environment in conjunction with the cosmetic surgeon. The dental treatment will, at least, give greater longevity to the treatment provided by the physician. New technology such as the cone beam volumetric bone scan provides us with the ability to statistically evaluate soft and hard tissue changes in three dimensions. This ability will give us a

greater understanding of the aging process and allow for better treatment planning.

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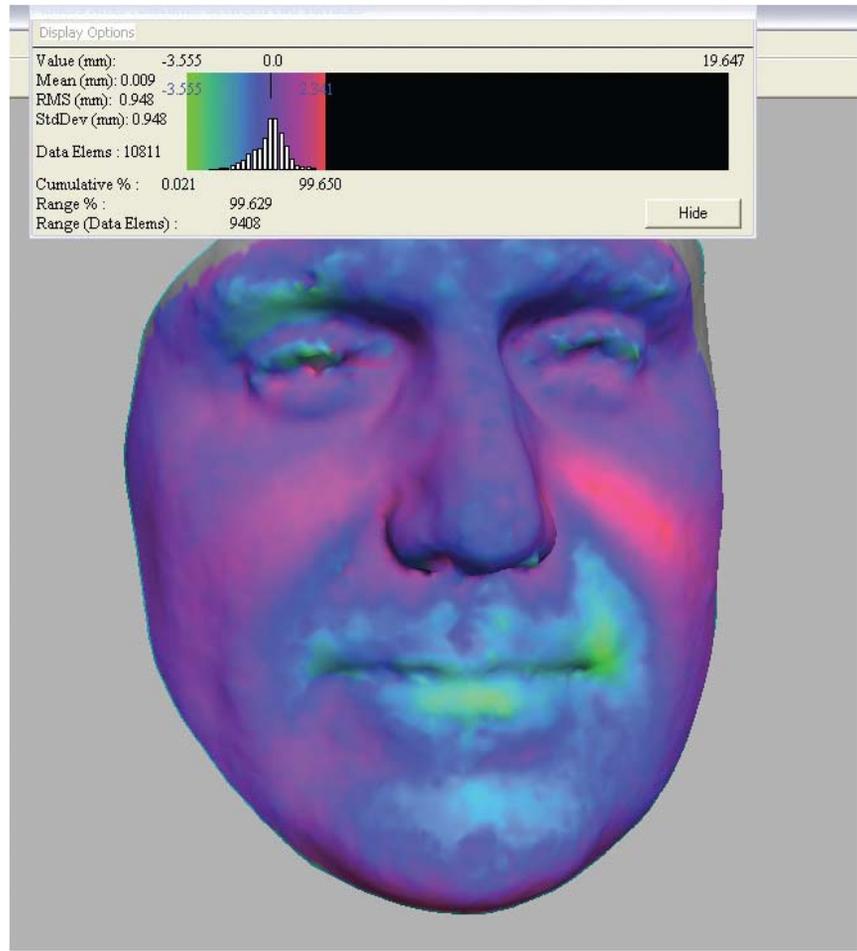


Figure 10: Similar changes can be seen in a male patient.

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