"Surgery First" Approach as an Alternative for Maxillomandibular Advancement in Patients with Obstructive Sleep Apnea

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Obstructive sleep apnea (OSA) is characterized by repetitive episodes of pharyngeal collapse, increased airflow resistance, and reduced oxyhemoglobin saturation during sleep.[1,2] Polysomnography (PSG) is the recommended sleep study for diagnosis of OSA,[3,4] based on an apnea-hypopnea index (AHI) score of >5 (the number of apnea and hypopnea events occurring per hour of sleep).[5,6]

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OSA has been associated with increased cardiovascular risk, insulin resistance, metabolic syndrome, excessive daytime sleepiness, fatigue, and automobile accidents; some reports show such neurocognitive alterations as loss of memory, concentration, motivation, and humor, resulting in a deterioration in the quality of life.[7,8] The first line of treatment for OSA is nasal continuous positive airway pressure (CPAP), working as a pneumatic splint that opens the upper airway,[9] but patient compliance is generally poor. Even in compliant patients, the actual usage of CPAP is only about 50% of what is prescribed.[10] When CPAP treatment is ineffective, more invasive approaches such as surgery may be considered.[11] With success rates between 75% and 100%, orthognathic surgery with maxillomandibular advancement (MMA) is the most effective surgical technique other than tracheostomy.[12-16]

An alternative method is the "surgery first" approach, in which orthognathic surgery is performed without presurgical orthodontic preparation and is followed by conventional orthodontics. Compared with the traditional approach, "surgery first" protocols can reduce overall treatment time considerably and avoid worsening facial esthetics and dental function during orthodontic preparation.[17-20]

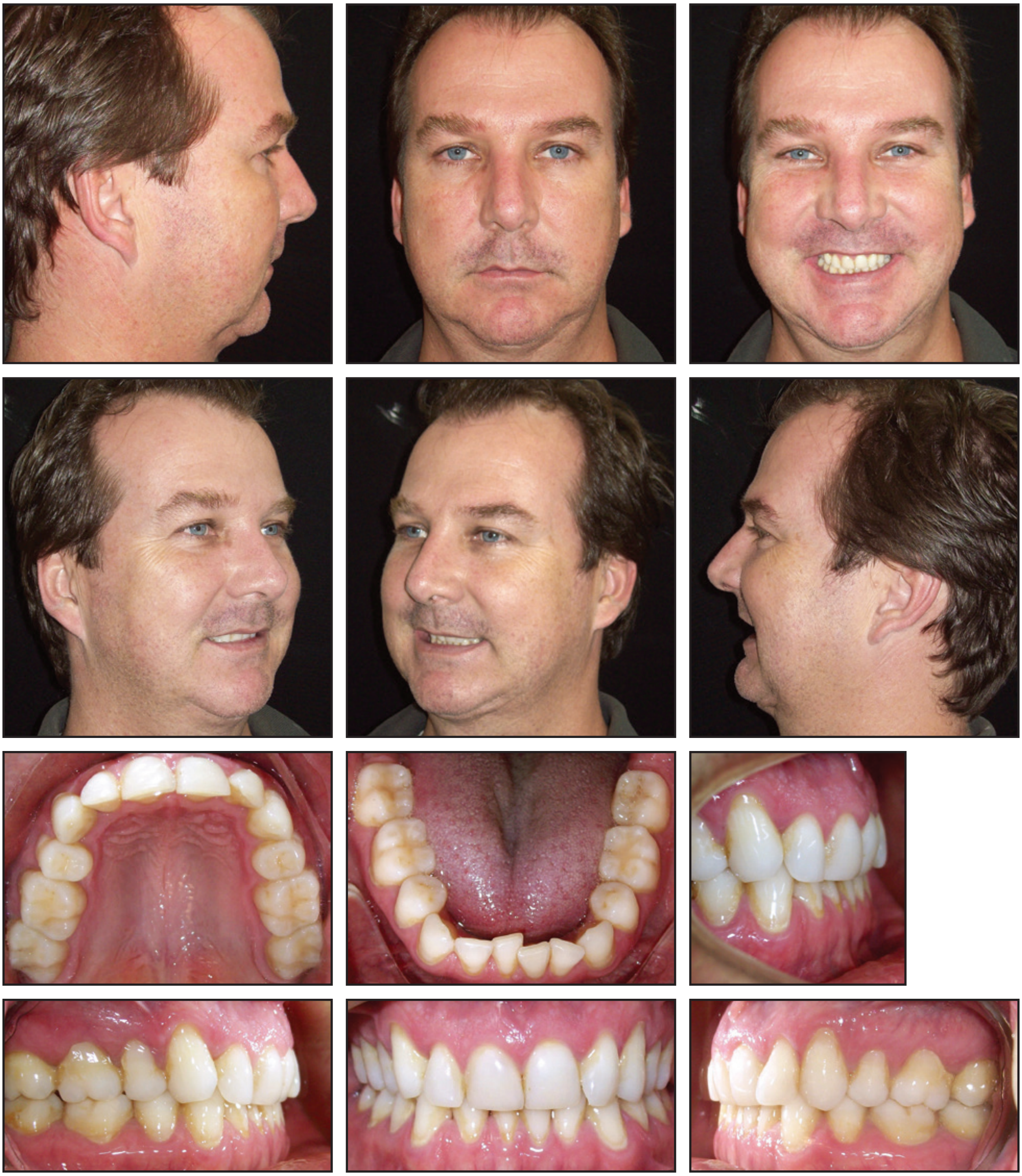

Fig. 1 45-year-old patient with Class I malocclusion, deep bite, narrow arches, retroclined incisors, and moderate crowding before treatment (continued on next page).

Case Report

A 45-year-old male patient with no medical history presented with the following chief complaint: "I want to improve my smile and my profile, and I also think I might have breathing difficulties." The patient was diagnosed with a convex profile, short throat length, and retrusive upper and lower lips (Fig. 1). He also had a Class I malocclusion, a deep bite, narrow arches, retroclined incisors, and moderate crowding; skeletally, he displayed a Class II hyperdivergent pattern, a dolichofacial biotype, and short mandibular condyles (Table 1).

Initial cone-beam computed tomography (CBCT) showed a reduced upper airway diameter (Fig. 2). A PSG was ordered, and the patient was diagnosed with OSA, based on an AHI score of 9.

The facial, dental, and functional treatment objectives involved achieving the patient's esthetic facial requirements, correcting the malocclusion, and improving the upper airway.

Treatment options included orthodontics to reduce the incisor retroclination; presurgical orthodontic treatment followed by MMA and postsurgical orthodontics; and a "surgery first" approach followed by orthodontics to level, align, and stabilize the occlusion. Surgical treatment was selected since it would address the patient's chief concern, while the MMA would improve the upper airway. "Surgery first" was chosen because the patient wanted immediate facial changes and also wanted to avoid any worsening of his profile, malocclusion, and OSA from presurgical orthodontic treatment.

One week before surgery, Damon Q* brackets with hooks were bonded, using high torque for the upper central incisors and standard torque for the upper canines, upper lateral incisors, and

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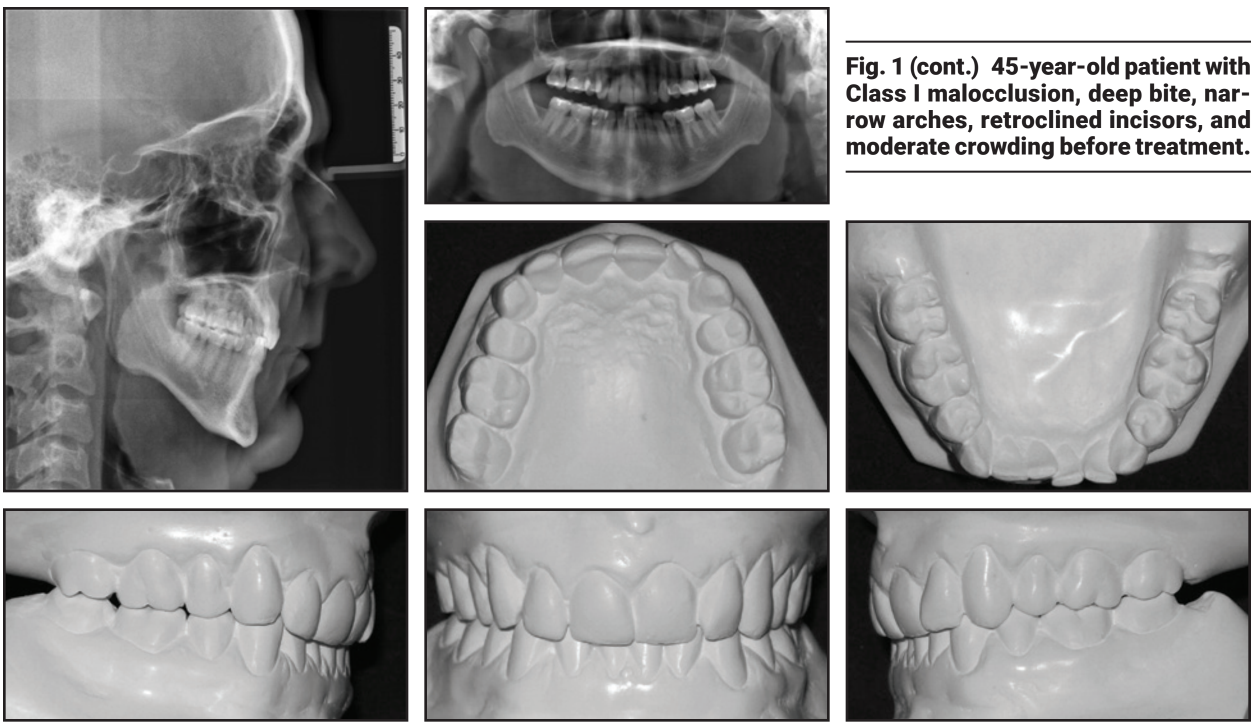

Fig. 1 (cont.) 45-year-old patient with Class I malocclusion, deep bite, narrow arches, retroclined incisors, and moderate crowding before treatment.

lower anterior teeth. To avoid changing the dental positions and ensure that the surgical splints fit properly, no archwires were placed. Surgical planning and prediction were done with SimPlant OMS** software (Fig. 3).

The surgery involved MMA of 10mm in the maxilla and 9mm in the mandible. Before intubation, .014" Copper NiTi* archwires were inserted in both arches. After surgery, $\frac{3}{16}$", 3.5oz intermaxillary elastics were placed from the upper

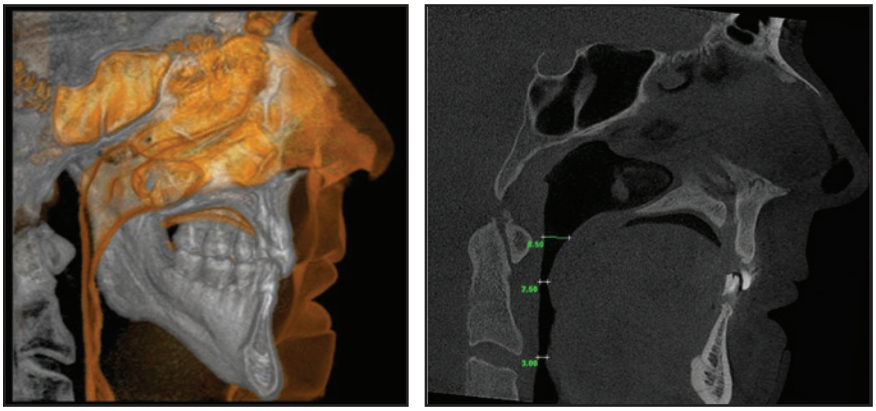

Fig. 2 Cone-beam computed tomography (CBCT) showing reduced upper airway before surgery.

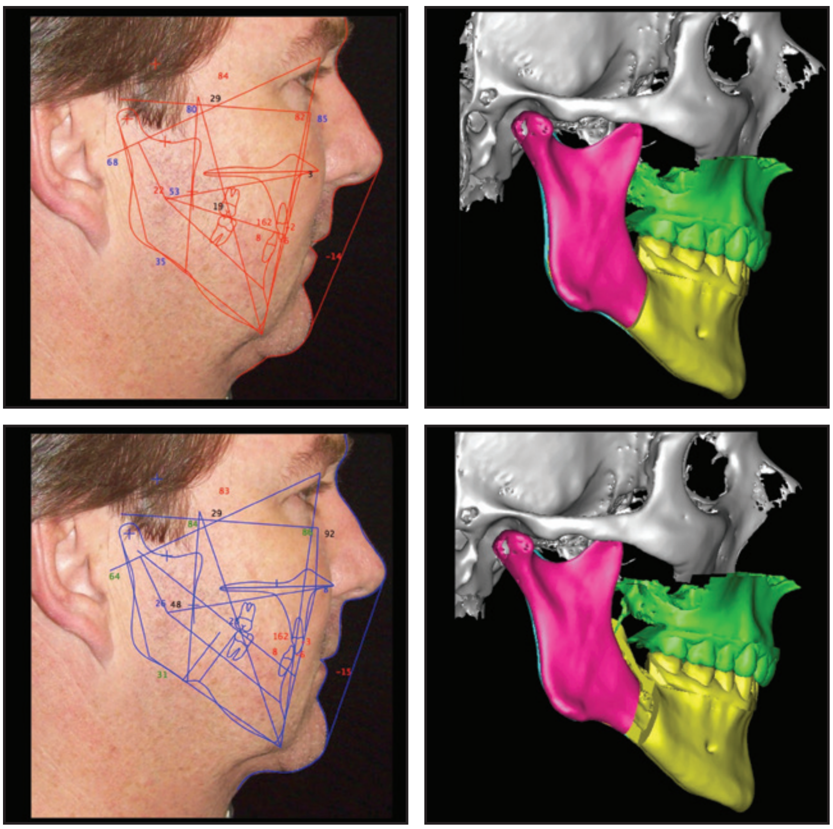

Fig. 3 Surgical planning and prediction with SimPlant OMS.**

TABLE 1
CEPHALOMETRIC ANALYSIS

	Norm	Pretreatment	Post-Treatment	30 Months after Treatment
SNA	80.0° ± 5.0°	74.0°	79.0°	78.0°
SNB	78.0° ± 4.0°	71.0°	77.0°	76.0°
ANB	2.8° ± 3.0°	3.0°	2.0°	2.0°
U1-SN	103.5° ± 5.0°	84.5°	96.0°	94.0°
IMPA	90.0° ± 7.0°	80.0°	89.0°	88.0°
U1-L1	135.4° ± 9.0°	152.0°	143.0°	144.0°

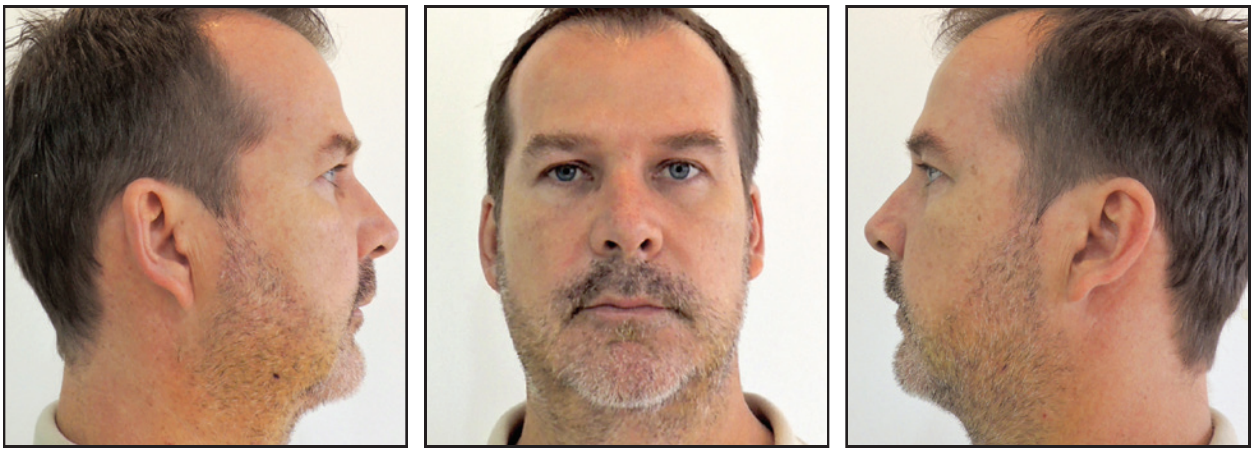

Fig. 4 Postsurgical facial photographs.

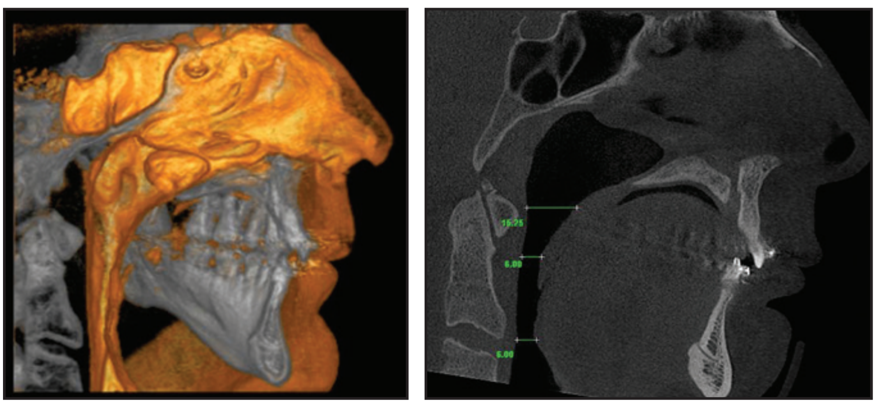

Fig. 5 CBCT after surgery, showing more than 100% increase in upper airway diameter.

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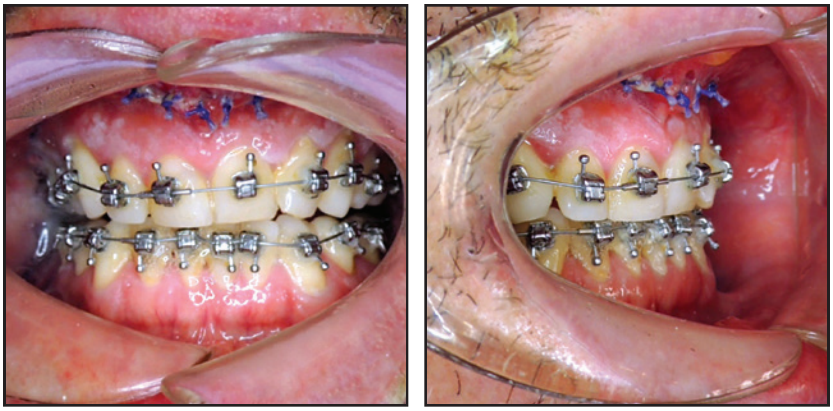

Fig. 6 Postsurgical leveling and alignment.

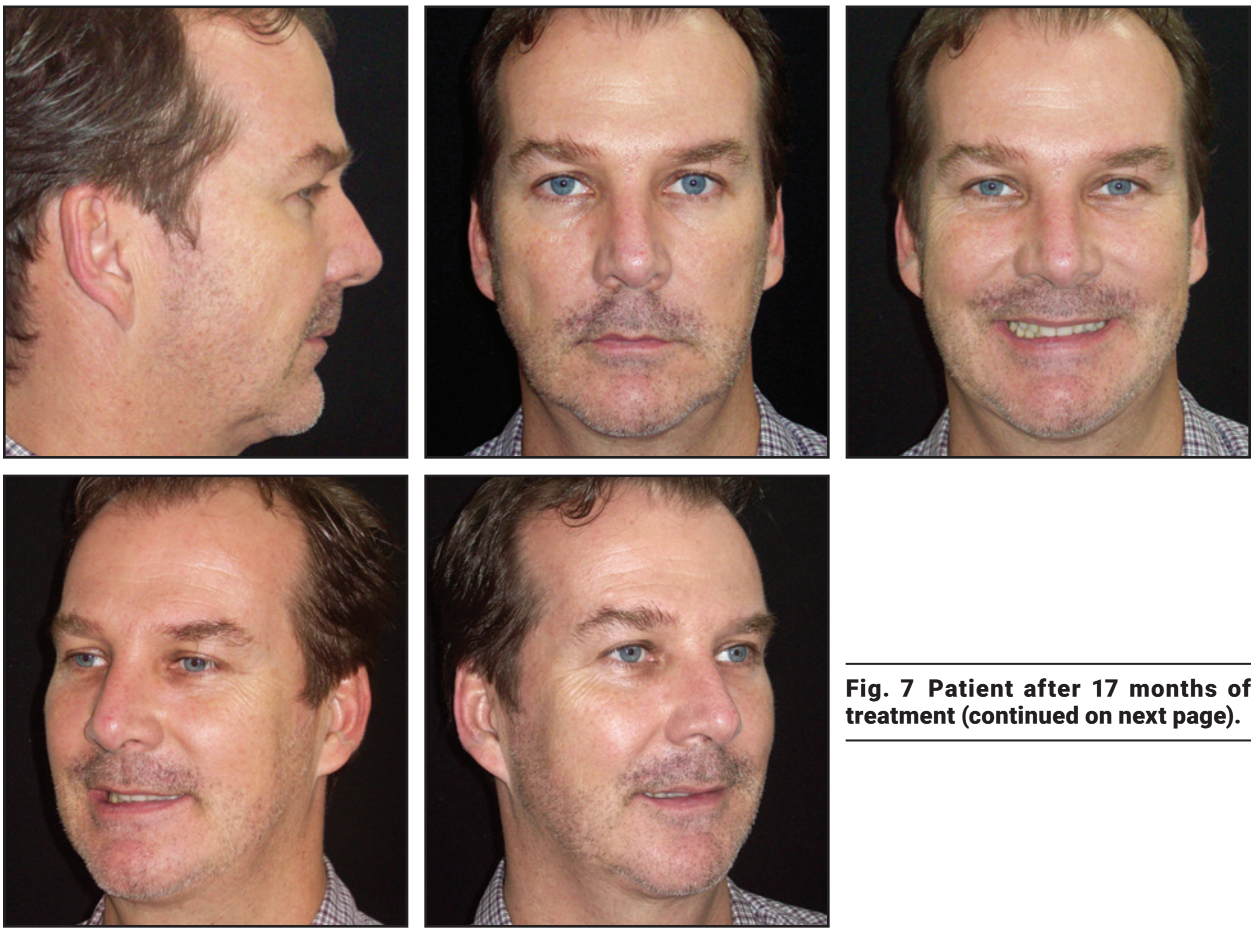

Fig. 7 Patient after 17 months of treatment (continued on next page).

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Fig. 7 (cont.) Patient after 17 months of treatment.

canines to the lower second premolars. An immediate improvement was observed in the soft-tissue profile after surgery (Fig. 4). The postsurgical CBCT showed an increase of more than 100% in upper airway diameter (Fig. 5).

Visits were scheduled every 15 days to take advantage of movement acceleration during the postsurgical leveling and alignment (Fig. 6). A conventional archwire sequence was used, progressing from .014" × .025" to .018" × .025" Copper NiTi. During the finishing stage, when appointments were scheduled every three weeks, upper .019" × .025" TMA* and lower .017" × .025" TMA archwires were used in combination with ¼", 3.5oz elastics.

Fig. 8 Patient 30 months after treatment (continued on next page).

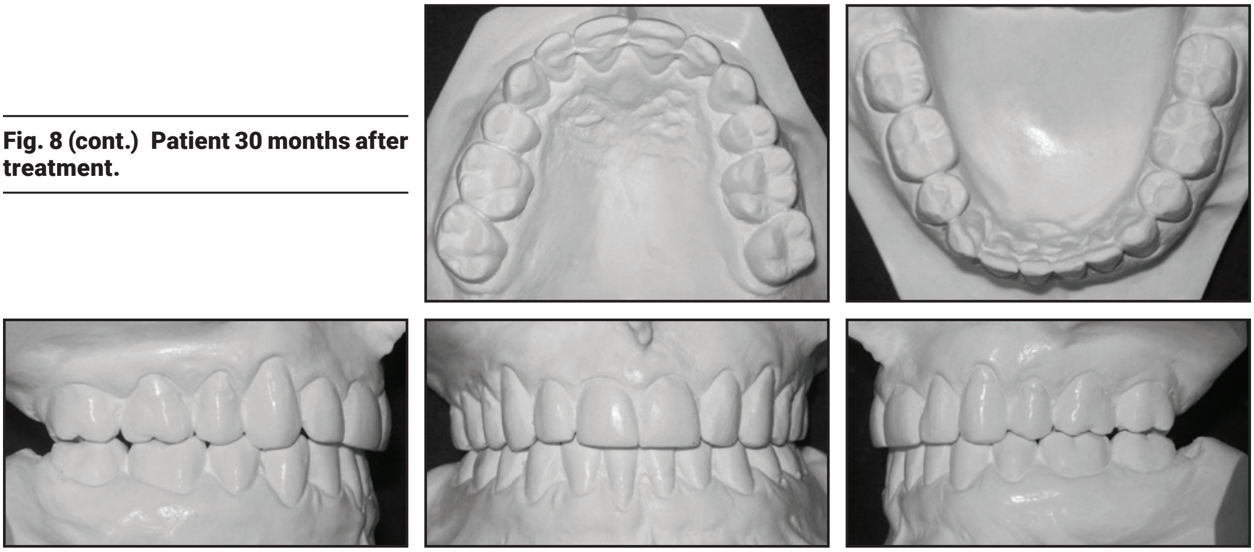

Fig. 8 (cont.) Patient 30 months after treatment.

After 17 months of treatment, the brackets were debonded. Post-treatment records confirmed that we had optimized the patient's facial and dental esthetics, improved the overjet and overbite, and aligned the dental arches into a functional Class I occlusion, with a considerable enhancement of his soft-tissue profile and upper airway (Fig. 7). In a post-treatment PSG, the AHI score was 4—within the normal range.

Upper and lower Essix*** retainers were delivered. Thirty months after treatment, the results remained stable, with only a minor relapse of the overjet (Fig. 8).

Discussion

The OSA diagnosis in this patient was performed by means of PSG, which is widely considered to be the gold standard for assessing sleep disorders.[3,4] Diagnosis of OSA is based on an AHI score of >5 and usually subdivided into mild (5 ≤ AHI > 15), moderate (15 ≤ AHI > 30), and severe (AHI ≥ 30).[5,6,21] Therefore, our patient had a mild sleep apnea disorder associated with bimaxillary retrusion. After an MMA was performed, the AHI was within the normal range.

The "surgery first" approach is an excellent treatment option for the correction of skeletal dysplasias, not only to reduce treatment time but also to improve patient satisfaction, thanks to the immediate improvement in facial esthetics.[18-20] In this case, we were able to achieve significant clinical changes in the upper airway—in some areas, a 100% increase in diameter—improving airflow and thus the prospect of resolving the OSA.

Because OSA is associated with significant morbidity and mortality, it has been gaining more attention from orthodontists. The "surgery first" approach can immediately address the problem without presurgical orthodontic treatment.[17] We recommend it in patients with sleep-disordered breathing, as long as the usual criteria for MMA are met and there are no contraindications such as severe occlusal instability (as indicated by the surgical setup) or molar roots that would interfere with the osteotomy cut. In these cases, we suggest a "surgery early" technique,[22] in which the specific issues impeding orthognathic surgery are corrected with orthodontics, and surgical treatment is undertaken as soon as possible to achieve rapid improvement of the upper airway.

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