

Up-to Date Review And Case Report

Mandibular propulsion and dental implant rehabilitation for an edentulous patient with class II malocclusion and severe obstructive sleep apnea

Hugues Lenganey^{1,*}, Simon Rasteau¹, Harmik Minassian², Gregory Murcier¹, Robin Jouan¹, Florent Borgnat¹

¹ Chirurgie Maxillo-Faciale, Centre Hospitalier de Villefranche sur Saone, 39 Plateau d'Ouille, 69400 Gleizé, France

² IMPLANTYS, 596 Bd Albert Camus Parc Avenue – Bat E, 69400 Villefranche sur Saône, France

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Abstract – Introduction: Orthognathic surgery can be a treatment for occlusal, oro-facial functional disorders and esthetics discrepancies as well as for obstructive sleep apnea. It is often practiced after an orthodontic preparation, but in edentulous patients, the preparation can be replaced with implant supported prosthesis to simulate the final occlusion. **Observation:** A patient presenting severe obstructive sleep apnea, vertical and sagittal insufficiency of the lower third of the face and poor dental health was treated with a guided mandibular advancement and an almost complete implant supported prosthesis rehabilitation. At first, the implants were placed and immediately loaded, giving the patient a class 2 occlusion. Then, an orthognathic surgery was performed, giving the patient a class 1 occlusion, and then the final prosthesis was made. **Commentaries:** The interest of this case is the combined treatment of the obstructive sleep apnea, the dental and facial deformities by mandibular retrognathia and the edentulous jaws. The gold standard for obstructive sleep apnea is a maxillary and mandibular advancement. In this case, for esthetic and anatomic reasons, a mandible propulsion alone has been performed, showing a positive and stable result for the treatment of obstructive sleep apnea. The use of surgical guide permitted to plan the treatment with more accuracy. **Conclusion:** This case combines a fixed prosthetic rehabilitation, which permitted to guide the orthognathic surgery and the treatment of obstructive sleep apnea.

Introduction

Obstructive sleep apnea (OSA) is characterized by insomnia, sleep-related breathing disorders, and other sleep disorders. Multiple complications are observed as cardiovascular diseases (stroke, hypertension, cardiac and coronary diseases), metabolic disorders (diabetes, dyslipidemia) and neuropsychological troubles. It is defined as an Apnea Hypopnea Index (AHI) of 5 or more [1]. According to the Stanford Protocol [2–4], the surgical indication can be set with 20 events per hour, or less if the patient has an excessive daytime fatigue.

For severe OSA, the first intention treatment is Continuous Positive Airway Pressure (CPAP).

Maxillomandibular advancement surgery is proposed for patients who are refusing or not tolerating CPAP [5]. It consists in a Le Fort I osteotomy and a bilateral sagittal split osteotomy

(BSSO) [4] with a maxillomandibular propulsion and counter-clockwise rotation. The success of the surgery is defined as a decrease of AHI over 50% and/or AHI under 10 events per hour [6,7].

A complete maxillomandibular dental rehabilitation consists in a complete implant-supported [8,9] fixed prosthesis which will make it possible to have an occlusal plan before the orthognathic surgery.

The aim of this case is the treatment of the class 2 occlusion, the OSA and the oral rehabilitation in the same sequence.

Observation

A 42-year-old patient was referred to the oro-maxillo-facial surgery department for a complete maxillo-mandibular dental rehabilitation. The patient had a medical history of cardiomyopathy treated with PERINDOPRIL and severe OSA with AHI of 41 per hour. Clinical and radiologic examination revealed an

* Correspondence: hugues.lenganey@chu-lyon.fr

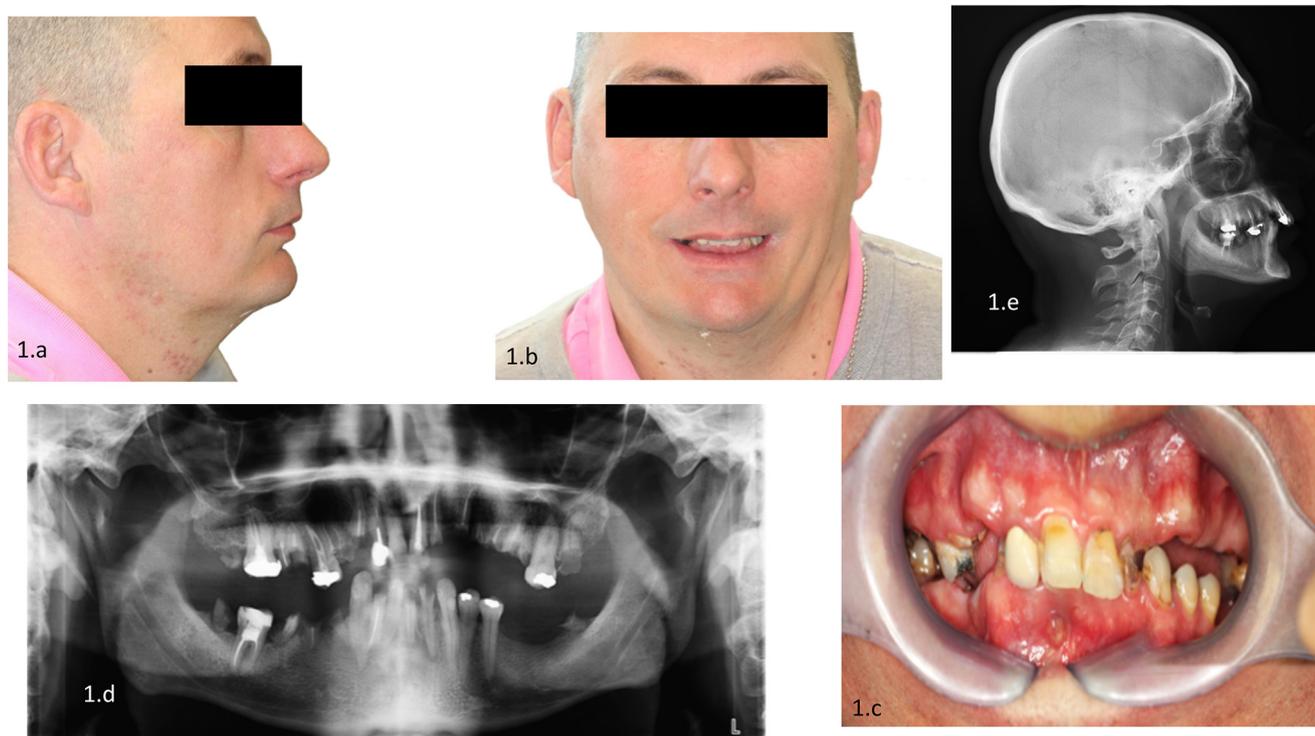


Fig. 1. (a) Face view before treatment, (b) profile view before treatment, (c) oral view before treatment, (d) orthopantomogram before treatment, (e) lateral cephalometric before treatment.

altered dental status (Figs. 1c and 1d) and a vertical and sagittal insufficiency of the lower third of the face (Figs. 1a, 1b, Fig. 1e).

The following treatment was set up by a multidisciplinary team of dentists, oral surgeons and maxillofacial surgeons.

At first, the avulsion of all teeth except 33-34-35 and 43 was performed after a compromise with the patient and his dentist. Three months later 6 maxillary and 6 mandibular dental implants (Nobel Biocare®, Kloten, Switzerland) were placed. The maxillary implants were immediately loaded with a fixed prosthesis.

A wax up model was made for the mandible and a removable prosthesis was prepared. In order to prepare the orthognathic surgery, an axial CT scan of the facial skeleton was performed to extract the corresponding DICOM and to import it in Mimics Medical® 18.0 software (Materialise®, Leuven, Belgium) to prepare the virtual model. Plaster occlusion models were optically scanned and integrated to the virtual models. The planning of the surgery was virtually performed in ProPlan CMF software (Materialise®, Leuven, Belgium) during a webmeeting with the surgeon and a clinical engineer (Fig. 2a). The guides (Fig. 2b) and custom plates (Fig. 2c) were performed on 3-matic 11 software (Materialise®, Leuven, Belgium) and then manufactured in a surgical grade titanium. The mandibular osteotomy was performed 3 months later in order to obtain a class I prosthetic based occlusion with a 12 mm mandibular propulsion (Fig. 3e).

The post-operative period was marked with a slow recovering lower lip dysesthesia, osteolysis in regard of the screws of the right titanium plate and fracture of the left titanium plate. The occlusion remained stable and similar to the simulation because of the beginning of bone consolidation. A new intervention was performed 6 weeks after the initial surgery to remove the plates and put conventional plates and a bicortical screw in the left mandible (GlobalD®, Brignais, France) (Fig. 3d). No complications were noticed after the re-intervention. At 4 month follow up, the bone consolidation was satisfying and the lower lip dysesthesia recovered completely after a few month.

A new analysis of the OSA by polysomnography performed 6 months later showed an AHI of 10. The definitive prosthesis was made 6 months after the last surgery to adjust the esthetic result (Fig. 3a and 3b) and dental occlusion (Fig. 3c).

Commentaries

The full arch implant-supported prostheses [8] were used to simulate the post-treatment occlusion and create surgical guides [10] and custom plates which permitted to set an ideal bone bases placement including condylar repulsion leading to an optimal functional and esthetic result. The use of surgical guides and patient-specific plates, engineered by computer-aided design and manufacturing (CAD-CAM) permitted to obtain predictable results and are particularly useful in complex cases.

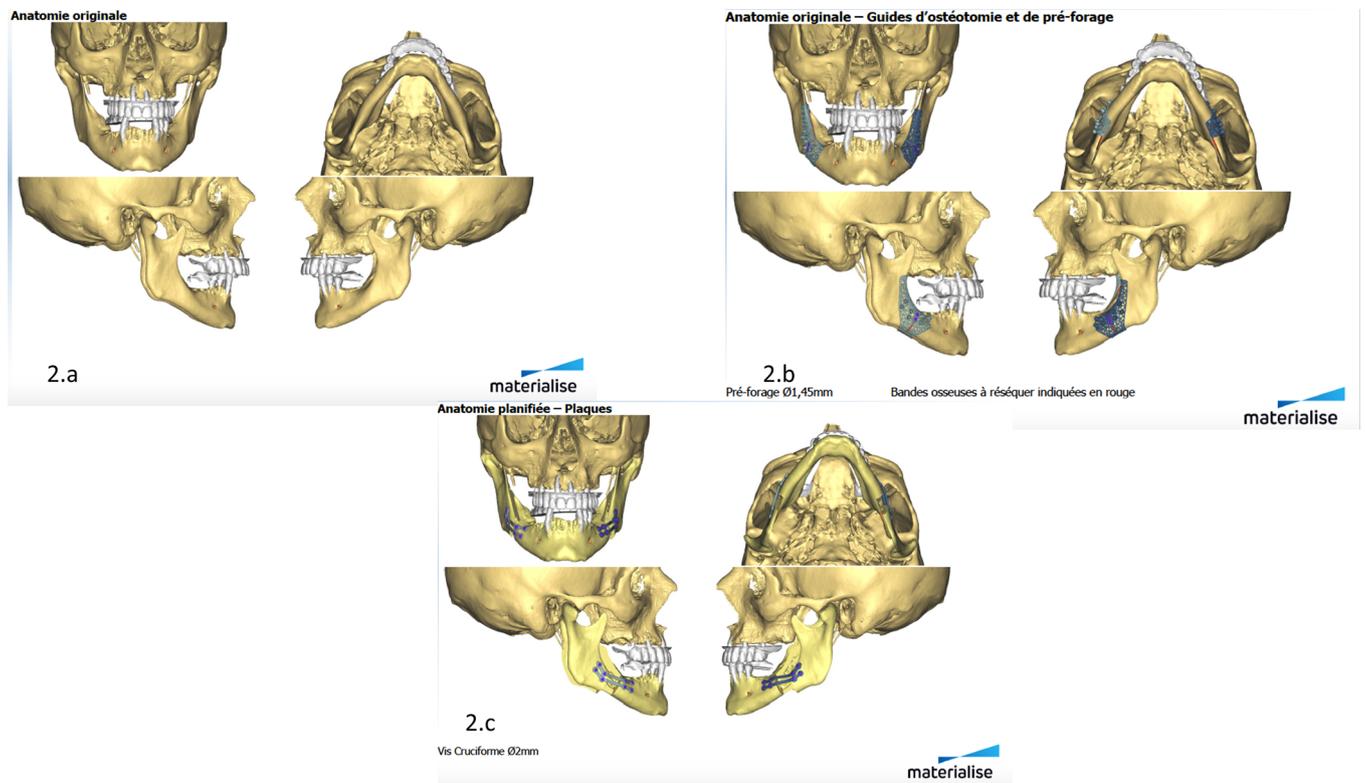


Fig. 2. (a) 3D model before orthognathic surgery, (b) 3D model with the guides set up, (c) 3D model after the simulation with the custom plates.

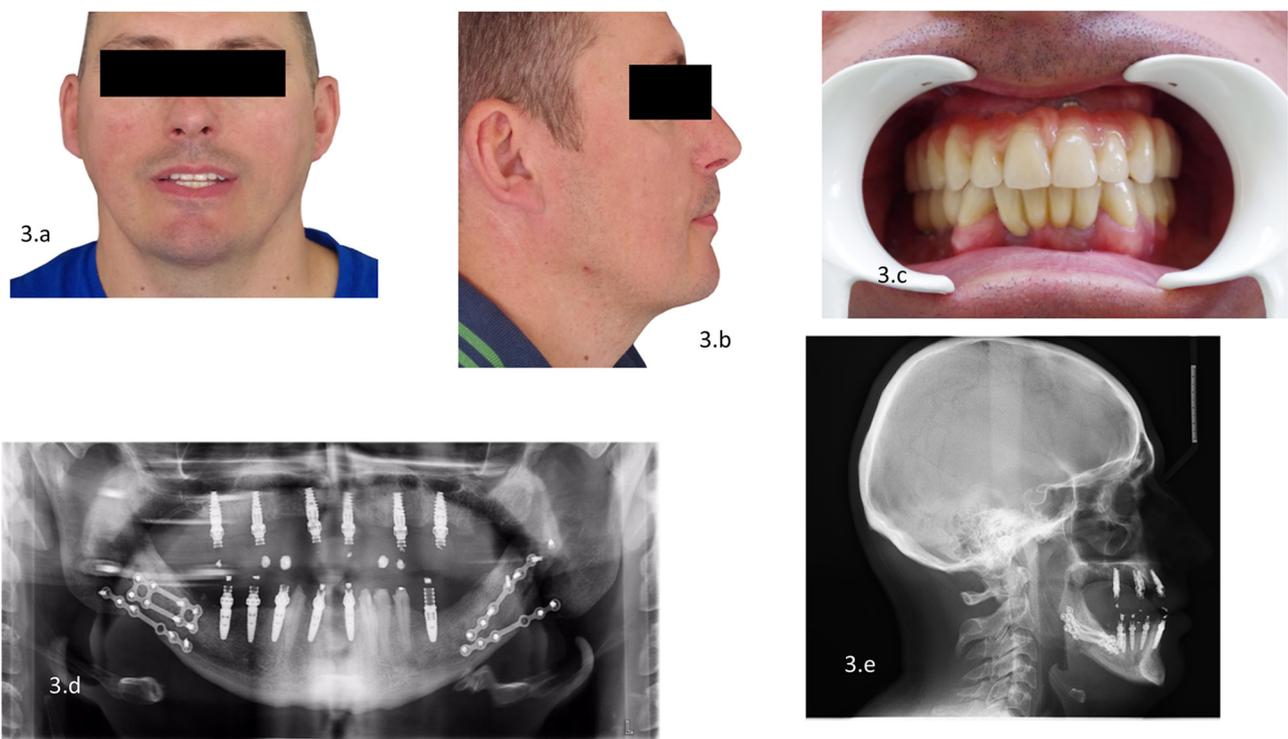


Fig. 3. (a) Face view after treatment, (b) profile picture after treatment, (c) oral view after treatment, (d) orthopantomogram after treatment, (e) lateral cephalometric after treatment.

This kind of treatment sequence can be compared with an ortho-surgical protocol. The class 2 occlusion has not been compensated with the implant supported prosthesis. The prosthesis has been designed to set the class 1 occlusion during the surgery.

A similar treatment sequence is usually set up for patients with severe maxillary atrophy requiring bone grafts, Le Fort I osteotomy and dental implants [11–14]. Le Fort I osteotomy is usually performed after the bone grafts and the implants placement [15].

Even if it is possible to perform orthognathic surgery before the implant placement, it would have consisted in our case in performing the BSSO on an edentulous patient [16]. This sequence provides more predictability for the planning and stability of the surgery. The implant supported prosthesis can be used to set an occlusion plan and to guide the surgery. It also permits to avoid difficulties resulting of orthognathic surgery performed on an edentulous patient in terms of planning and predictability [16]. Also, in this case, the patient was young with an hypertrophy of the masticatory muscles, an orthognathic surgery without occlusal wedging, risk of lack of bone consolidation would have been too high. No case of virtual planning of BSSO based on implant fixed prosthesis have been found in literature so far.

According to Vigneron *et al.* [7], patients with severe OSA have to fulfil some criteria to be considered as good candidates for maxillomandibular advancement: age < 45 years, body mass index (BMI) < 25 kg/m², AHI < 45 events per hour, SNB angle < 75°, a retrobasilingual space < 8 mm, with prior orthodontic preparation and without comorbidity.

In this case, the patient was <45 years old, had <45 events per hour, an SNB angle of 76.7°.

Indication of orthognathic surgery was esthetical, occlusal and functional for the OSA. The alternative treatment was a CPAP treatment associated with a full-arch rehabilitation with a prosthetic compensation of the class 2 which is not satisfying according to the bad tolerance of the CPAP [5], the absence of correction of the dysmorphia, the esthetical disorders and the risk of prosthetic fracture due to an important cantilever.

The Stanford recommendations for sleep-apnea surgery consist in a maxilla-mandibular propulsion with a counter-clockwise rotation [4] but some authors showed that it was possible to have an effectiveness on the volume of the airways after practicing a mandibular advancement only [17,18]. The propulsion was set with 12 mm and. An additional Le Fort I osteotomy and maxillary propulsion would have led to a too important mandibular propulsion to maintain the class I occlusion. The patient had also an open nasolabial angle and maxillary movements would have change the nasolabial anatomy with the risk of being unaesthetic [19,20].

Conclusion

A multidisciplinary approach with implantologist, oral surgeons and maxillofacial surgeon was mandatory to treat this

patient with full arch restoration by implants followed by virtual planning and guided mandibular osteotomy. OSA, edentulous jaw and maxillomandibular discrepancy have been treated by a single surgical sequence during which the implant placement and the prostheses permitted to plan and guide the orthognathic surgery.

Conflicts of interests

The authors declare that they have no conflicts of interest in relation to this article.

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