52nd SIDO -18th AIDOR INTERNATIONAL CONGRESS

FORTEZZA DA BASSO - FIRENZE, ITALY
NOVEMBER 11-13, 2021

Fall in... SIDO

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SIDO Società Italiana di Ortodonzia

Accademia Italiana DI ORTODONZIA

Digital diagnostic workflow for orthodontic/orthognathic treatment of severe skeletal class III malocclusion: a documented case report.

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Background

Orthognathic surgery planning including clinical examination, two-dimensional lateral cephalometric radiographs, plaster models, face bow, articulators and photographs has long been followed as the gold standard for optimal outcome .
Aim: Three-dimensional virtual imaging and planning techniques offer the advantage of combining information from the soft tissues of the face, skeleton and dentition allowing both the orthodontist and the surgeon to obtain more predictable outcomes .

Patient and method

A 17-year-old male patient attended an orthodontic consultation presenting a skeletal class III malocclusion, facial asymmetry, sagittal and transversal deficiency of the medium third of the skull, dental crowding, and bilateral crossbite (Fig.1). Accordingly with the patient a treatment plan involving SARPE (Surgically Assisted Rapid Palatal Expansion), to correct the transverse dimension of the upper jaw, followed by a combined orthodontic-surgical treatment with maxillofacial intervention involving LE FORT I and BSSO (bilateral sagittal surgical osteotomy) was choosen.
The first phase involved maxillary expansion with SARPE, in this reguard **a** HYRAX maxillary expander, was applied 2 days before surgery. Afterwards, 10 activations of the expander screw were administered. Moreover, two activations per day were performed until the screw was completely open (Fig.2). After 6 months of retention, a fixed 0.022 self ligating appliance with SS rigid arches was bonded to obtain occlusal decompensation up to pre-surgical preparation. An orthodontic software (i.e., Dolphin 3D Surgery) was used to perform virtual treatment objectives (VTO) evaluation by integrating data from cone beam computer tomography (CBCT) acquisition, intraoral scan and extraoral photograph (Fig. 3 - 4). Once the final position of both jaws was defined, the "Splint tool" function of the 3D Dolphin software was used to design and print the splints accordingly with the previously assesed treatment objectives (Fig. 5 - 6). The surgical procedure followed the pre-planned settings for LE FORT I and BSSO approaches for the skeletal correction of the dysmorphosis and were finalized with osteosynthesis plates and screws. After the healing of soft tissues, an eight weeks home physiotherapy was scheduled to increase speech, chewing and joint mobility.

Conclusions

The orthodontic/orthognathic combined treatment allowed to correct skeletal and dental imbalance, as well as the improvement of facial aesthetics (Fig. 7). Virtual planning offers new possibilities for visualizing the relationship between dental arches and surrounding bone and soft structures in a single virtual 3D model, allowing the specialists to simulate different surgical and orthodontic procedures to achieve the best possible result for the patient and providing an accurate and predictable outcome in the treatment of challenging malocclusions.
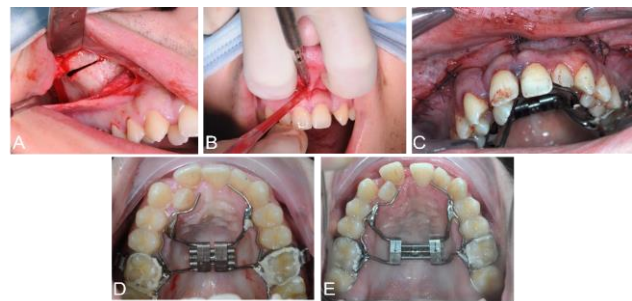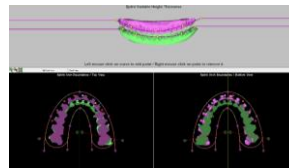

Figure.2 Surgical procedures: osteotomy underneath the zygomatic process bilaterally (A) and in the anterior median region (B); suture (C); HYRAX maxillary expander pre and post activation (D, E)
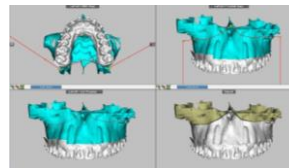
Figure. 3 Preparation of Le Fort I surgery in a virtual environnement.
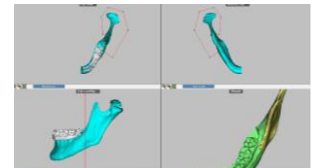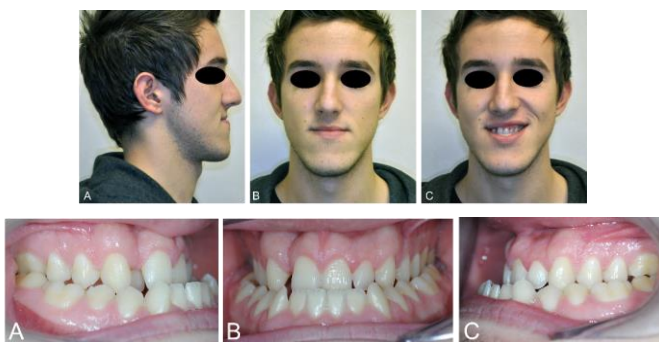

Figure. 4 Preparation of BSSO surgery in a virtual environnement.

Figure. 5 Surgical splint, virtual planning.

Figure.6 (A,B) Surgical splint, virtual 3D model evaluation(A) and printing (B)

Figure.1 Extra-oral and intra-oral evaluation, before treatment.

Figure.8 Extra-oral and intra-oral evaluation, after treatment.