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case report

SURGERY-FIRST: A NEW APPROACH TO ORTHOGNATHIC SURGERY

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SUMMARY
This case study describes the treatment of a 20-year-old white woman with a skeletal Class III and dental Class III malocclusion followed by a retrognathic and contracted maxilla, light mandibular crowding and a median line deviation of 5 mm.
The treatment was based on the Surgery-First approach, involving LeFort I maxillary advancement surgery, and it was followed by orthodontic treatment.
During the 6-month treatment period, excellent aesthetic results and good functional occlusion were achieved.

Key words: orthognatic surgery, Surgery First Approach.

Introduction

Nagasaka (1) (2009) proposed a new approach to correct dental and skeletal malocclusions: "the Surgery-First approach". This therapeutic approach involves an orthognathic surgical intervention without pre-surgical step; the surgery of skeletal bases is performed as a first step and it is followed by post-surgical orthodontics, that is usually of very short duration. Uribe et al. (2) show that the Surgery-First approach can reduce the treatment duration.
The high rate of effectiveness of post-surgical orthodontics re-establishing a good occlusal relationship is partly due to a synergy established between the orthodontic forces and the dental arches normally adapted together, when the skeletal bases are in a good three-dimensional relationship, and partly to an acceleration in bone remodelling at the base of the orthodontic movements (3). This therapeutic approach brings relevant advantages for the patients, in terms of a reduced therapy and aesthetical benefits without any aesthetic deterioration, thanks to the orthodontic decompensation (4).

Diagnosis

A 20-year-old white woman came to the orthodontic clinic located at the George Eastman Hospital in Rome.
Her medical history was non-contributory, and the examination of the temporomandibular joint was normal.
The pre-treatment facial examination showed facial asymmetry, with an increase in the lower third of the face and little marked nasogenial furrows.
The cephalometric analysis showed a skeletal Class III relationship (ANB 0.7), an hyper-divergence of skeletal bases (FMA 31.8°), proclined maxillary (U1-Palatal Plane 123°) and retroclined mandibular incisors (IMPA 80.2°) (Table 1).
The intraoral examination showed that the patient had a full complement of teeth. The molar relationships were Class III on the left side and Class III on the right side.
The patient showed a median line deviation to the right by 5 mm.
The diagnosis was skeletal asymmetry, skeletal and

Table 1 - Pre- and post-treatment cephalometric measurements. Cephalometric Analysis.

	Norm	Pre-treatment	Post-treatment
HORIZONTAL SKELETAL			
SNA (°)	82.0	82.4	83.5
SNB (°)	80.0	81.7	80.4
ANB (°)	2.0	0.7	3.1
Maxillary Skeletal (A-Na Perp) (mm)	0.0	0.7	1.5
Mand. Skeletal (Pg-Na Perp) (mm)	- 4.0	-4.0	-1.3
Wits Appraisal (mm)	0.0	-8.8	-3.8
VERTICAL SKELETAL			
FMA (MP-FH) (°)	26.0	31.8	33.9
MP-SN (°)	33.0	40.2	41.8
Palatal-Mand Angle (°)	28.0	28.9	28.8
Palatal-Occ Plane (PP-OP) (°)	10.0	9.3	5.9
Mand Plane to Occ Plane (°)	17.4	19.6	22.8
ANTERIOR DENTAL			
U-Incisor Protrusion (U1-Apo) (mm)	6.0	7.1	7.5
L1 Protrusion (L1-Apo) (mm)	2.0	4.7	4.1
U1 – Palatal Plane (°)	110.0	123.2	120.6
U1 – Occ Plane (°)	57.5	47.5	53.5
L1 – Occ Plane (°)	72.0	80.2	74.9
IMPA (°)	95.0	80.2	82.3

dental Class III malocclusion accompanied by retrusive and contracted maxilla, light mandibular crowding, and a median line deviation to the right by 5 mm.

Treatment planning

After a careful extraoral analysis, the treatment planning is carried out by using the Dolphin Digital Systems that can generate VTO (Visual Treatment Objective) overlapping the pre-surgical cephalometric tracing with the post-surgery one on the basis of the programmed skeletal movements.

First, a VTO is generated, with repositioned dental elements and even the skeletal bone bases.

As demonstrated by Alfaro (5), the position of the maxillary central incisor may play a relevant role for the correct treatment planning.

First, the Ricketts' occlusal plane (passing through molars and premolars) is oriented to establish what the maxillary incisor vertical position will be, 2-3 mm below the occlusal plan. If the lips are normal, the distance between the incisor tooth and the upper lip stomion (2-3 mm) is a good vertical reference.

With regard to the inclination, the value of 56° has been identified as the correct one by Arnett (6-8).

While the sagittal reference plane has been obtained by TVL (True Vertical Line), the vertical line – that passes through the skin sub-nasal point and is perpendicular to the natural head position – can be observed when the patient looks at an object on the horizontal line or, more easily, when she looks at yourself in the mirror.

According to Arnett, the TVL should be repositioned in case of surgery-treated Classes III, by 1-2 mm forward. Generally, this distance should be of 9 mm (6-8).

Once the position in three space planes of the maxillary central incisor has been established, the position of the maxillary is arranged. At this point, lower incisor and mandibular position is evaluated.

Finally, VTO for the Surgery-First approach is created to move only the maxillaries towards the correct position, but not the teeth, which remain in the same position after the surgery. Based on VTO, the technician

will construct the splints requested by the maxillofacial surgeon to move it correctly.

Treatment objectives

The goals of the whole treatment for this patient were to align the maxillary and mandibular dental arches, to improve the maxillary and mandibular incisor inclination, to obtain ideal overjet and overbite, to correct the deviation of the lower median line, to achieve a good functional occlusion, and finally to improve the skeletal and soft tissue profile.

Progress in the treatment

The complete dental arch bandage is realised two days prior to the surgical intervention. Twin joints are used and the whole treatment is carried out based on the straight-wire MBT technique. Around each bracket, Kobayashi steel ligature wires 0,12 are applied to let the surgeon stabilise the maxillary repositioning by means of elastic bands.

The surgery consists of a Lefort I sagittal osteotomy and maxillary advancement by 2 mm. At the end of the surgical intervention, the patient is stabilised with resin splints and anterior and posterior elastic bands at the right side. After six months, the sequence of used arches is nitinol arch 0.14 first, followed by nitinol 0.16 and nitinol 0.16 x 0.22. Successively, TMA arches 0.17 x 0.25 are used to combine them with Class III and medial line elastic bands in order to correct the light deviation. The length of treatment is of 6 months, achieving optimal aesthetic and functional results.

Treatment results

At the end of the treatment, the maxillary and mandibular dental arches were well-aligned, achieving a well-interdigitated occlusion with Class I molar and Class I canine relationships. In addition, optimal overjet and overbite were obtained. The maxillary and mandibular midlines were coincident with the facial midline, and a consonant smile arc was also achieved. The post-treatment cephalometric analysis showed significant improvements in the skeletal relationship (ANB angle shifted from 0.7 to 3.1), the maxillary incisor inclination (from 123.2° to 120.6°), and the mandibular incisor inclination (from 80,2° to 82,3°). Superimposition of the pre-treatment and post-treatment cephalometric radiographs showed an advancement of the maxillary denture base by 2 mm. At the end of the treatment, the patient was extremely satisfied with the treatment results and duration. The results were stable for 5 months after the completion of the treatment.

Discussion

"Surgery-First" allows to eliminate or reduce the pre-surgical orthodontic treatment, to rearrange surgically the maxillaries in the most desired position and finally to perform a short-term orthodontic therapy. This method has proven very useful for the patient – who can immediately see the improvement in the facial aesthetics – and it reduces significantly the duration of the orthodontic therapy (9).

Ko et al. (10, 11) compared surgically treated cases of skeletal Class III with pre-surgical orthodontic treatment with those without pre-surgical orthodontic treatment. They stated that the treatment outcome and long-term stability were comparable and did not show significant differences. Simultaneously, Park et al. (12) observed that there were no significant differences in terms of post-surgery stability.

The main problems, related with the orthodontic pre-surgical therapy, are represented by the facial aesthetic duration and deterioration due to an inadequate dental decompensation. According to Luther et al. (13), the therapy duration ranges from 7 to 47 months. Furthermore, over that period, compliance can be negatively affected (14).

Yu et al. (9) demonstrated that, thanks to the advantages of the earlier improvements in the patient facial aesthetics and dental function, to the reduction in the treatment complexity and duration of the orthodontic management, and to the increased patient acceptance,

Surgery-First approach can be regarded as an ideal and valuable alternative to the other potentially complicated procedures.

In addition, Surgery-first approach can reduce the orthodontic treatment duration after surgical interventions (3). This is made possible by the resolution of skeletal alterations, but also of soft tissues, that allow the orthodontist to carry out the therapy once a balance between the various components is struck. In this case, musculature plays an important role in the orthodontic treatment and does not counter dental movements (2).

Moreover, after the orthodontic surgery, an increase in blood flow related to a better post-surgical healing and increased bone turnover were observed. This finding may accelerate the orthodontic treatment.

As previously stated, the short-term orthodontic treatment duration, in the period immediately after the orthognathic surgery, is caused by a phenomenon defined as RAP (Regional Acceleratory Phenomenon). Liou et al. (3) demonstrated that the orthognathic surgery triggers an intense osteoclastic activity for 3-4 months and a metabolic alteration at the dental-alveolar level that favour dental mobility and accelerate the movements. In this way, Surgery-First accelerates the decompensation process. However, the temporal extent and duration of this phenomenon are still under discussion.

Moreover, Huang (4) states that Surgery-First approach uses osteotomy to solve most of the skeletal and dental problems and to simplify the post-operative orthodontic treatment by providing a treatable malocclusion, for which only anteroposterior orthodontic movement is required mostly, with minimal transverse or vertical orthodontic movements.

Naturally, not all the cases can be solved with this technique and its limits are still to be studied and defined correctly.

Surgery-First approach can treat different cases; however, specific criteria can identify the ideal cases for this kind of approach. The ideal case is characterised by a malocclusion associated with skeletal malformation, a moderate-minor crowding, maxillary central and lower incisors with a normal inclination or that are slightly proclined or retroclined, and minimal transversal incongruity.

Ko et al. (10) observe that the factors causing instability in the Surgery-First approach include a larger overbite, a deeper curve of Spee, a greater negative overjet and a greater mandibular setback. The initial overbite may be an indicator of a possible skeletal relapse of the mandibular setback.

Although Surgery-First can be applied to both second and third Classes, different Authors agree that the majority of treated cases are Class III malocclusions associated with previously reported characteristics and it can be applied successfully to cases characterised by at least three occlusal stops, placed between the upper and lower teeth.

Moreover, Choi et al. (15) suggest that the Surgery-First approach achieves similar results to conventional orthognathic surgery, and it is a predictable treatment that can be easily applied to the skeletal Class III as a valid alternative to treat the above-mentioned conditions.

Conclusions

Usually patients turn to the orthodontist to correct their dental skeletal alterations for aesthetic reasons. Surgery-First allows to avoid aesthetic deterioration due to dental compensation and to achieve immediate results when the surgical intervention is performed and to have better compliance from the patient. With Surgery-First, there will be a reduced treatment duration of 12-18 months, eliminating the pre-surgical orthodontic phase.

The reduction in the treatment duration thanks to Surgery-First is due to the resolution of skeletal and soft tissue alterations and RAP (Regional Acceleratory Phenomenon).

Surgery-First represents a small revolution in the dental and skeletal malocclusion therapy, that also requires a sinergy between the orthodontist and the maxillofacial surgeon.

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