Function, Aesthetics and Biomimetics in the Interdisciplinary Treatment:
Concerning a Clinical Case

Abstract
The evolution of dentistry and dental specialties allowed for a clear improvement in the quality of treatment results for the patient's complete oral rehabilitation, considering both functional and aesthetic aspects.

An adult patient's aesthetic and functional rehabilitation present an even more difficult challenge for the dental professional, particularly in those situations where the treatment involves an intimate collaboration between different specialties, demanding a critical planning.

We will present a clinical case which involved an interdisciplinary approach, where the operative sequence and the multidisciplinary approach exerted in this case illustrates the importance of specialised knowledge and professional communication.

Key words: Aesthetics, Periodontics, Implantology, Orthodontics, Interdisciplinary approach.

Introduction
An adult patient's aesthetic and functional rehabilitation presents a challenge for the dentistry professional, particularly in those situations where the treatment involves an intimate collaboration between several specialties, demanding a critical planning. It is therefore important to define in what way aesthetic, periodontal, implantology and orthodontic specialists should connect in order to properly achieve the proposed goals.

As an example of an interdisciplinary treatment, we present a complex clinical case in an adult patient where periodontal, implantology, orthodontic and prosthodontic treatment were involved.

Case Description
A fifty-eight year old female patient consulted us to replace her missing teeth and to improve her smile's appearance. This is a case of a patient with high expectations and a philosophical personality according to House's classification.1

In medical terms, she was diagnosed as an ASA patient type 1,2 not presenting any associated pathology and not being under any kind of medication. She was non-smoker and had a moderately stressful life style.

Extra-orally, we can observe in figures 1 and 2 that the patient presents a facial type with normal patterns and a straight profile. It is also obvious in figure 1 that the patient presents a low smile line.
During intraoral examination we could observe the presence of posterior bite collapse with decreased occlusal vertical dimension resulting from the loss of posterior teeth number 14, 15, 24, 25, 26, 46 and 36, and from the mesioversion of teeth 47 and 37, as well as the extrusion of tooth 16 (Figs. 3-5). It was also possible to detect the presence of localized gingival recessions both in the upper and lower arches.

The intraoral examination also showed an increased overjet due to labial inclination of upper anterior segment with an increase of the horizontal overbite, which resulted in the absence of the anterior guide during protrusive movement. At the same time, we could observe the presence of a parafunction (bruxing habit), since there is a clear wear at the upper anterior teeth’s incisal edge (Fig. 6).

After examination of the upper anterior segment, gingival asymmetry was observed, especially at teeth 11 and 21, as well as presence of interincisal diastema that might have been caused by the labial movement of these teeth (Fig. 3) and/or the loss of teeth posteriorly. The upper anterior teeth present themselves with an inadequate height – width proportion and the incisors show a somewhat triangular shape.

The periodontal examination showed moderate generalized chronic periodontitis, with Plaque index values of 80% and Bleeding of 48% (Dicotomic Index). One can verify, as mentioned earlier, the presence of multiple areas of gingival recession. The microbiological analysis allowed to observe the presence of periodontal pathogens of endogenous character, therefore not presenting an increased risk in terms of response to the periodontal treatment.

In the initial radiographic examination, it was possible to confirm the presence of periodontal pathology, with a moderate radiographic horizontal bone loss except for tooth 27, which presents a circumferential defect. The detected bone loss is worsened due to the mal-positioning of some teeth (Fig. 7). We could also observe the clear buccalization of the antero-superior teeth in the lateral cephalometric projection (Fig. 8).

**Diagnosis**
The patient can be diagnosed with:
- Moderate Generalized Chronic Periodontitis.
- Bite Collapse Syndrome with buccal inclination of the anterosuperior teeth and presence of inter-incisive diastema.
- Extrusion and mal-positioning of several teeth as well as posterior edentulism.
- Bruxism.
- Asymmetry of the anterior gingival margins and incorrect width-length ratio of anterior teeth.

**Treatment Outcome**
After the analysis of the presented case we can summarize our treatment plan as follows:

1. Treatment of the periodontal pathology.
2. Alignment of the remaining molars and increase of the vertical dimension.
3. Retrusion of upper incisors decreasing the horizontal overbite and reestablishment of an adequate anterior guide.
4. Closure of the interincisal diastema and gingivoplasty.
5. Reconstruction of the lost dental structure of the upper anterior segment.
6. Replacement of the lost teeth.
7. Treatment of the occlusal parafunction.

**Treatment Plan**

Hence our treatment plan consisted of the following, according to the sequence we have described:

1. Initial or hygienic stage, with information and motivation for the interdisciplinary treatment as well as implementation of a basic periodontal treatment.
2. Placement of osseointegrated implants in the sites of 14, 15, 24 and 25.
5. Extrusion of tooth 47.
6. Placement of implant in the area of 46.
7. Placement of ceramic crown over implant in 46 and of implant-supported metaloceramics fixed partial prosthesis in the 14, 15 and 24, 25, 26.
8. Rehabilitation of the anterosuperior sector with ceramic veneer.

1. **Initial or hygienic stage, with information and motivation for the interdisciplinary treatment as well as implementation of a basic periodontal treatment**

The goal of the periodontal treatment was to eliminate the opportunistic microorganisms that might impede, if not treated, any kind of interdisciplinary therapeutic approach.

The initial or hygienic stage aims to eliminate the etiologic cause of the periodontal disease; eliminating all the bacterial deposits, as well as the plaque retaining factors. During this stage, we proceeded with the patient’s motivation, instructing her on oral hygiene techniques.

Therefore, in theory, with the basic periodontal treatment we should get:

- A reduction of the Bleeding Index to values equal or inferior to 25%.
- A total elimination of gingival pockets with probing depth of over 5 mm.
- Reduction of the furcation lesions.
- The elimination of pain since the only pain that the patient had was due to periodontal problems.
- Starting to achieve the patient’s functional and aesthetic satisfaction.

At the same time, we must have the ability to effectively control the risk factors associated with chronic periodontal disease, such as bacterial plaque, tobacco and uncontrolled diabetes. In this particular case, the need to improve the used oral hygiene techniques was to promote a better plaque control. From the above mentioned risk factors, bacterial plaque was the only one initially present. In terms of active treatment, we proceeded with the root planing in the sites with probing depth of over 3 mm. Forty-five days after the basic stage’s completion, we proceeded to the re-evaluation of the performed treatment.
Re-evaluation aimed to assess the results of the established treatment and to plan the need for additional periodontal treatment (surgical, for example) or supporting periodontal treatment. In the analyzed clinical case, and considering the good results obtained (plaque index values and bleeding inferior to 20%) with the initial treatment it was possible to move the patient to a supporting periodontal treatment program. The periodicity of the appointments relative to the program is dependent on the present risk factors, on the degree of initial bone loss presented and on the treatment's complexity to be executed in interdisciplinary terms. For this patient periodontal supporting appointments with a 2-month periodicity were prescribed.

2- Placement of osseointegrated implants in positions 14, 15, 24 and 25
Considering the edentulous spaces and bearing in mind the orthodontic movement to be performed it was decided to proceed with the placement of osseointegrated implants in the position of teeth 14, 15, 24 and 25 in the maxilla and tooth 46 in the mandible. The decision was made in order to maintain teeth 27 and 47 as orthodontic anchorage and to re-evaluate their status after orthodontic treatment ends.

For both sides in the maxilla, the need to perform sinus elevation was verified, although on the right side such procedure was performed at the same time of the implant placement as there was over 6 mm of residual bone (Figs. 9-11), but on the left side, the necessity to perform a previous elevation of the maxillary sinus floor arose as we did not have sufficient alveolar bone to achieve primary stability, and afterwards (6 months) we proceeded with the placement of the implants (Figs. 12-16).

3- Setting of provisional fixed partial prosthesis over implants 14, 15, 24 and 25 for orthodontic anchorage
After the implants' osseointegration period (6 months), we proceeded with a casting and record registration for the fabrication of a fixed partial prosthesis, screwed in metal-acrylic, allowing, on one hand, the re-establishment of a suitable vertical dimension and on the other hand, an additional anchorage during the execution of the orthodontic treatment.

4- Bimaxillary orthodontic treatment with fixed appliances
The orthodontic treatment began with the alignment of mandibular teeth (Fig. 17).

In a later stage, already with a steel rectangular arch, of a bigger gauge, the verticalization of tooth 47 was initiated, resorting to an open spring of nickel-titanium.

After tooth 47 verticalization, the alignment of maxillary teeth was initiated (Fig. 18).

This arch being leveled and aligned, we proceeded with the recoil of the anterosuperior sector, with steel contraction arches and resorting to the anchorage provided by the implants previously placed in teeth positions 14, 15, 24 and 25 (Fig. 19).

The canine neurolclusion was achieved and improved in an initial stage through the use of triangular rubber bands placed bilaterally (Fig. 20).
5- Extraction of tooth 47
As previously anticipated, tooth 47 extraction was decided due to its periodontal bad condition (Fig. 21).

6- Placement of implant in the position of 46
Besides the implant at the site of tooth 46 and since tooth 47 extraction was performed, the possibility of also placing an implant at the site of this last tooth was taken into consideration. Nevertheless, the bone availability was limited and it would imply the use of guided bone regeneration technique which was not accepted by the patient at this stage of the treatment. The risk that might exist from tooth 17 extrusion was not confirmed due to the centric relation splint foreseen for the end of the treatment (Fig. 22).

7- Placement of ceramic crown over implant in 46 and of implant-supported metaloceramics fixed partial prosthesis in the 14, 15 and 24, 25, 26
Right after the bimaxillary fixed orthodontic appliances removal (that were used for 18 months), as well as after the osseointegration period of the implants placed in the mandibular arch, we proceeded with the definitive impressions using an elastomeric material, as well as to the collection of intermaxillary registrations which allowed the elaboration of structures built in metal-ceramics, which were cemented over prefabricated intermediate abutments. As for the second quadrant, we decided for an implant-supported structure design over implants in positions 24 and 25 and a cantilevered pontic at the level of tooth 26 (Fig. 23).

8- Rehabilitation of the anterosuperior sector with ceramic feldspar veneers
After the removal of the fixed appliances we also proceeded with the anterosuperior segment rehabilitation. In order to do so, we performed a previous waxing up, in order to be able to visualize the intended final result. This wax up also made possible the attainment of an in-mouth “Mock-up”, as well as it functioned as a guide during all the dental preparation process, creation of temporary restorations and the execution of ceramic feldspar veneers (Fig. 24).

The dental preparation based on the previous wax up insured a thickness of approximately 0,5 mm in buccal and 2 mm in the incisal 1/3 in order to assure a suitable thickness for the feldspar ceramic. The vestibular and palatal finish line was a deep chamfer to assure an easier positioning of the definitive restorations and to promote a higher marginal integrity after the definitive cementation (Figs. 25, 26).

In these areas in which the preparation included the exposure of dentin, we recommend the use of an immediate dentinal sealing technique by applying phosphoric acid and a dentinal adhesive (of fourth or fifth generation) on areas of exposed dentin, where after a first cycle of 20 seconds curing an oxygen inhibitor (glycerine gel) was applied in order to perform a second cycle of curing, assuring a total sealing of the exposed dentinal tubules. We also intended, by doing this, to increase final adhesion values during the cementation of the ceramic feldspar veneers.

After the dental preparation, we proceeded with the definitive casting as well as with the intermaxillary registrations, determining the vertical dimension of the occlusion to be used.
The cementation technique included the acid conditioning of both enamel and dentin with phosphoric acid and of the interior surface of the veneers with hydrofluoric acid. We proceeded with the silanization of the interior surface of the veneers, placed an adhesive of fourth generation on the restorations and on teeth without curing, used a photo-curable micro-hybrid resin cement and performed the final cementation (Figs. 27, 28).

9- Placement of centric relation occlusal splint

Despite the thought that the incisal and canine guides’ re-establishment will solve the parafunction problem, we decided to produce an occlusal splint that will allow, on one hand, to reduce the parafunctional habits’ effects and that will simultaneously allow it to function as a retainer for the orthodontic treatment performed at the maxilla (Figs. 29, 30).

Discussion

After the clinical case treatment, the main discussion topics are:

1. no placement of implant at the site of tooth 26.
2. the possible extraction of tooth 27 and the extraction of tooth 47.

As to what concerns tooth 26, no implant was placed because the initial planning foresaw the extraction of tooth 27, which would make the implants location to be at 24, 25 and 27. However, and since the tooth was maintained as a result of the periodontal treatment, a cantilever was made supported on the 24 and 25 implants. Obviously, and once the case was finished, we could claim that it might have been preferable to place them at the sites of the 24 and 26. Nevertheless, the performed treatment did not present any kind of problem as far as the long term predictability is concerned.

Relatively, tooth 47 had to be extracted due to periodontal causes. The ideal would have been to also place an implant at that level. However, as above mentioned, the bone availability was limited and it would imply the use of guided bone regeneration technique, not accepted by the patient at this stage of the treatment. The risk that might derive from tooth 17 extrusion was not confirmed due to the centric relation splint foreseen for the end of the treatment.

Conclusion

The evolution of dentistry and dental specialties allowed for a clear improvement in the quality of treatment results for the patient’s complete oral rehabilitation, considering both functional and aesthetic aspects. Naturally, the excellence of the results demands an interdisciplinary approach, consolidated in a close collaboration between the different protagonists where the patient’s motivation and availability is pivotal. The therapeutic planning, the operative sequence and the pluridisciplinarity exerted in this case illustrate the importance of specialised knowledge and professional communication.

References