

## Case Report

## CAD-CAM technology and immediate loading for advanced dental rehabilitation.

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**Abstract:** The world of implantology is continuously expanding. The application of computer-aided design and computer-aided manufacturing (CAD/CAM) to advanced dental rehabilitation programs is one of the most interesting innovations in this area. In fact, this technique offers high precision and simpler fabrication protocol. This paper describes three cases of advanced dental rehabilitation carried out using CAD-CAM technology associated with immediate functional loading protocols for reducing to the minimum the surgical times. Extremely positive results were evidenced in our patients. Aesthetic and functional outcomes, as well as prostheses stability, were satisfactory. The main aim of the present report is to show the brilliant outcomes that we obtained with the use of this procedure. We highlight that this method may guarantee numerous advantages such as shorter treatment time, elimination of human error in the manufacturing process and positive aesthetic and functional outcomes. Furthermore, it facilitates the performance of surgery.

**Keywords:** CAD-CAM technology, immediate loading, advanced dental rehabilitation, prosthodontics

**INTRODUCTION:**

Prosthodontics is dedicated to return the altered function, anatomy, phonation and aesthetic of oral cavity due to lack of teeth. It represents a constantly evolving world. In this line, the application of CAD/CAM technology to dental orthopedics represents one of the most interesting innovations in this field [1].

In industry, the use of CAD/CAM methodology offers high precision and simpler fabrication protocols. Moreover, the need of human intervention during the generation of the prostheses is limited to the minimum necessary [1]. These features ensure great results in terms of manufacturing accuracy, production costs and product quality.

For all these reasons, CAD/CAM technology was embraced in dentistry [2]. In this area, CAD-CAM helps to achieve considerable time and cost savings in laboratory procedures [3]. Moreover, it guarantees positive aesthetic and functional outcomes. The main aim of the present reports is to show the possible applications of CAD-CAM systems in oral implantology. We report three cases of advanced dental rehabilitation with immediate loading treated with this technology.

**CASE REPORTS:****Case 1:**

We describe the case of a 43-year-old woman with no significant medical history. Smoker (5 cig/day). Patient was previously treated in our clinic for severe gum disease and grade III mobility of four central incisors. In those times, we decided to treat the case with three immediately loaded implants placed in the incisor region. Yet only four years later (2014), she was referred to our clinic again. In fact, gum disease worsened.

A new clinical exploration showed grade II mobility of numerous teeth, bad breath and severe gum disease with active purulent drainage of periodontal pockets in molar region (Fig 1 and Fig 2). On the basis of these factors, we indicated oral antibiotic treatment (with clindamycin and metronidazole) and an intensive periodontal treatment with the aim to reduce the bacterial content of oral cavity before beginning dental rehabilitation. Finally, we decided to carry out the extraction of all natural teeth, a surgical curettage of all periodontal pockets, injection of antibiotic into dental sockets and an extensive gum paste. Once this procedure was successfully completed, patient underwent implant surgery. Eight Q2 Trans alveolar implants with external Hex produced by Trinona

®Germany were placed in lower jaw. In contrast, six implants (with the same features as the earlier ones) were inserted in the upper jaw (Fig. 3).

Once surgery was completed, a dental impression was taken. According with immediate loading protocols, the impression was immediately forwarded to the dental laboratory. Finally, hybrid prosthesis was fabricated with CAD-CAM system from two blocks of polymathic methacrylate (PMMA). It was placed nine days following the surgery. Clinical course was favourable and patient could resume a normal diet immediately. In addition, patient referred good chewing function and satisfaction with aesthetic result (Fig. 4).

#### Case 2:

An 81 years old partially edentulous woman consulted our clinic. Patient suffered severe chronic polyarthritis (that determined serious mobility deficits) and moderate cognitive impairment. Thus, there was a need to minimize the treatment time.

A careful clinical examination shows grade III mobility of remaining teeth of the upper jaw, severe chewing disorder and serious atrophy of jaw bones (evidenced with orthopantomography). Against this background, we indicate oral antibiotic treatment with clindamycin and metronidazole.

Moreover, we decided to perform a dental rehabilitation using a hybrid prosthesis produced with

CAD/CAM system. As before an immediate loading protocol was associated. Five Qza implants with internal Hex platform (produced by Trinion ®Germany) were placed into the upper jaw for securing the prosthesis support. Clinical course was positive.

#### Case 3:

A 63 years old woman, with no significant medical history was referred to our clinic by her dentist. Patient presented a long history of dental restorative treatments with bad evolution. Thus, she was seeking for an advanced dental rehabilitation program with immediate loading. Clinical examination shows severe gum disease of maxilla, periapical infection of 11/13/21/23, grade III mobility of numerous teeth, bad breath and severe alveolar bone resorption. In view of that, we indicate a course of oral antibiotic treatment (with clindamycin and metronidazole). Moreover, we decided to extract all patient natural teeth and remove the tooth-supported prosthesis. In this line, we carried out a surgical curettage of all periodontal pockets, injection of antibiotic into dental sockets and extensive gum pasty. As before, we also utilized a hybrid prosthesis produced with CAD/CAM system from blocks of PMMA. This time too, we carried out an immediate functional loading protocol to resolve the case. Dental prostheses were supported by eight Q2 transalveolar implants with external Hex produced by Trinion ®Germany. Clinical course was favorable. No complications were observed one year after surgery.



Fig-1: Clinical image of the severe chronic adult periodontitis suffered by patient.



**Fig-2: Orthopantomography image before implant surgery.**



**Fig-3: Orthopantomography image after surgery.**



**Fig-4: Final result. 9 months after surgery.**

## DISCUSSION:

CAD/CAM technology is the most modern technique in the field of fixed dental prostheses. It represents a considerable acceleration on previous methodologies.

In fact, impressions of the patient's teeth are scanned and the dental prostheses are manufactured by computer assisted mechanization (CAM). It allows achieving a major diagnostic accuracy. Moreover, its qualities offer a high degree of precision in the manufacture of the dental prostheses. There are three major steps for performing a dental rehabilitation with CAD-CAM system:

- A- It is necessary to perform a scan of teeth or dental implants that would be rehabilitated.
- B- A specific software generates a 3D prostheses model within minutes.
- C- The robotized drilling of the final prostheses performed by an industrial machine completes the cycle.

Two classes of materials are used in the production of CAD/CAM restorations: glass-ceramics/ceramics, and resin composites [4, 5]. Dental prostheses based on composite blocks ensure excellent functional and aesthetic results [6]. Furthermore, the applicability of immediate loading protocols allows reducing the total treatment time [7]. In this light, is important to note that certain precautions must be taken when an immediate loading protocol is performed. First, the average time between surgery and final prosthesis placement must not exceed two weeks. The reason for this is that primary implant stability is progressively reduced during the first few weeks following surgery if immediate loading has not begun [8-10]. In addition, is imperative to obtain the highest implants stability using the minimal torque force ( $\geq 25$  Ncm) [11]. Optimal primary stability is essential for immediate loading (implant stability quotient  $> 55$ ) [10]. Second, the choice of an adequate implant design is essential to attain great outcomes. Accordingly with our experience, we affirm that conical implants may be more appropriate for this type of surgery. Its shape helps to achieve the proper degree of primary stability [12]. Third, the appropriate treatment of patient periodontal disease is mandatory. Surgical curettage of all periodontal pockets, injection of antibiotic into dental sockets and procedures of gum pasty should be carried out when indicated.

Concluding, we would stress that we evidenced extremely positive results in our patient. Aesthetic and functional outcomes, as well as prostheses stability, were satisfactory. These data were confirmed eighteen months after surgery.

## CONCLUSION:

CAD/CAM technology offers the following advantages:

- A- Great aesthetic and functional outcomes.
- B- Shorter treatment time if it is associated with immediate load protocols.
- C- Shorter manufacturing times for prostheses production.
- D- Increase in the accuracy of the final product.
- E- Elimination of human error in the manufacturing process.

Moreover, this system helps the clinician during implant surgery. It enables the surgeon to know the exact position where the implants should be placed.

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## Competing interests:

The authors declare that they have no competing interests

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