CASE REPORT

Prosthetic restoration in frontal maxillary area using digital technologies: Case presentation (Part I)

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ABSTRACT

Digital technologies represent new alternatives in prosthetic rehabilitation of all kinds of maxillary or mandibular spans. This article is composed of two parts, in which different technological aspects will be presented regarding the prosthetic restoration of frontal maxillary areas using the CAD-CAM technology, but using different material for resistance framework, both veneered with ceramic materials to restore the aesthetics. The main materials that will be used are: Co-Cr dental alloy and zirconium dioxide (zirconia).

KEYWORDS: zirconia, dental bridges, ceramic masses.

INTRODUCTION

"The smile is a scene in which there are 32 actors, who have a very important role to play, and 2 of them are the main actors in the scene of the smile," say Frush and Fisher[1-4]. And these 32 actors are actually the 32 teeth, which constitute the permanent dentition of each individual, starting even from adolescence. They start their formation from the sixth week of intrauterine life. Later, they end up contributing substantially to the fulfilment of certain functions in the daily life of the human subject, among which we mention: mastication, phonation, physiognomy, etc.[1-4].

GENERAL DATA

Currently, each individual puts a lot of emphasis on the way they look (appearance), but above all on the smile, sometimes using certain dental procedures to improve their physiognomy, therefore implicitly to improve the smile as well[1-4].

Using state-of-the-art technology and materials, prosthetic restorations of superior quality and long-lasting durability can be achieved. The most used materials for obtaining the resistance structures of prosthetic restorations used in current dental practice are zirconium dioxide (zirconia), as well as chromium-based alloys as: cobalt-chromium (Co-Cr) and nickel-chromium (Ni- Cr), which are later plated for physiognomic purposes with ceramic masses of different categories[1-4].

Thus, in this material structured in 2 distinct parts, prosthetic rehabilitation in the maxillary frontal area will be analyzed by manufacturing prosthetic restorations through CAD-CAM digital technology, but using 2 different materials for the resistance infrastructure, which will later be plated with ceramic masses. The materials used are: metal alloy based on Co-Cr and zirconium dioxide (zirconia).

CASE PRESENTATION

Prosthetic restoration in the maxillary frontal area on zir-

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Figure 1. Functional maxillary impression, mandibular arch impression and occlusal registration.

conium dioxide support (zirconia)

A 50-year-old male patient presented to the dental office to improve the aesthetic appearance of the frontal area of teeth 1.3-2.3, being affected by multiple carious processes treated, with colour modifications, or untreated. Taking into account the patient's desire regarding the aesthetic rehabilitation of the maxillary frontal area, the dentist together with the dental technician, having the written consent of the patient, chose to manufacture a prosthetic restoration of the 6 teeth (1.3-2.3) on zirconium dioxide support (zirconia) infrastructure, obtained by CAD-CAM technology, subsequently plated with ceramic masses for physiognomic purposes. After performing the endodontic treatments on teeth 1.3-2.3, all 6 teeth were prepared to obtain the corresponding dental abutments, in order to make the prosthetic restoration.

Next, the dentist made a functional impression in a standard impression tray in 2 steps, with condensation silicone

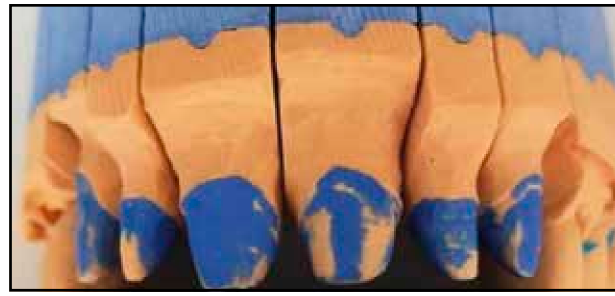

Figure 2. Sectional maxillary model obtained using Pindex technology.

materials of different consistencies: putty and light body (Figure 1). The occlusal relationship was determined separately using a condensing silicone strip of putty consistency. The impression of the antagonistic mandibular arch was also made in the standard impression holder, but with an irreversible hydrocolloid. After the impressions were obtained, they were decontaminated by immersion in specific antimicrobial disinfectants, following the manufacturers' recommendations.

The two models were cast, a sectional maxillary model obtained using the Pindex technology (type IV dental stone was used for the main model, while the base of the model was made of type III dental stone), the mandibular model was cast using the classic process (type III dental stone was used) (Figure 2).

After obtaining the functional sectional model, the dental abutments were trimmed and a layer of spacer was applied in order to create the future space for the luting material. The models were then mounted in the occlusal simulator, using the occlusal record.

The maxillary and mandibular models will be scanned using a laboratory scanner, and the design of the future zirconia infrastructure will be made on the virtual model (Figure 3). The design will be done using the professional Exocad

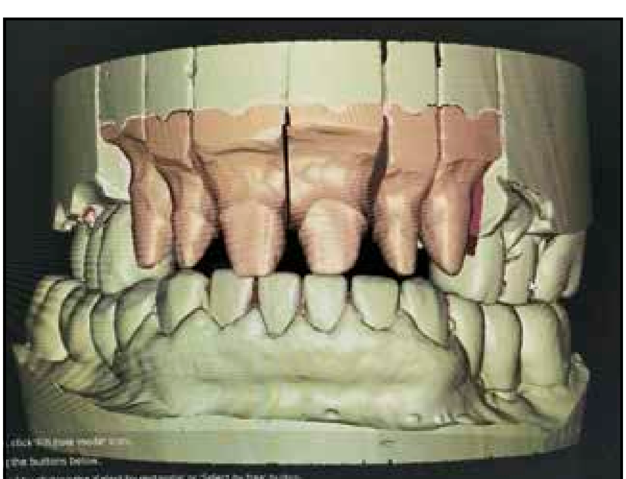

Figure 3. The virtual models obtained after scanning the physical models, placed in occlusion.

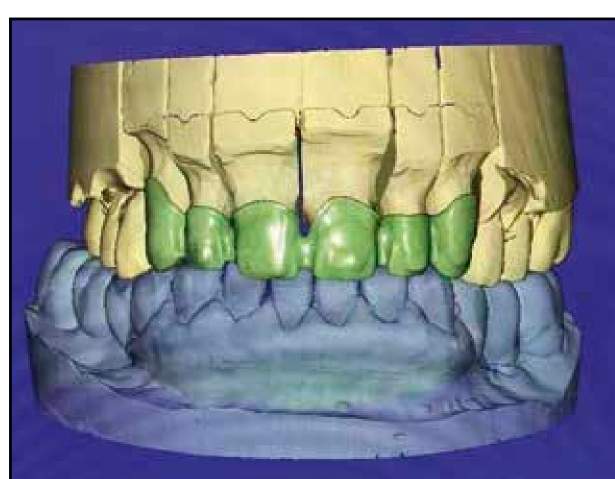

Figure 4. The design of zirconium dioxide substructure.

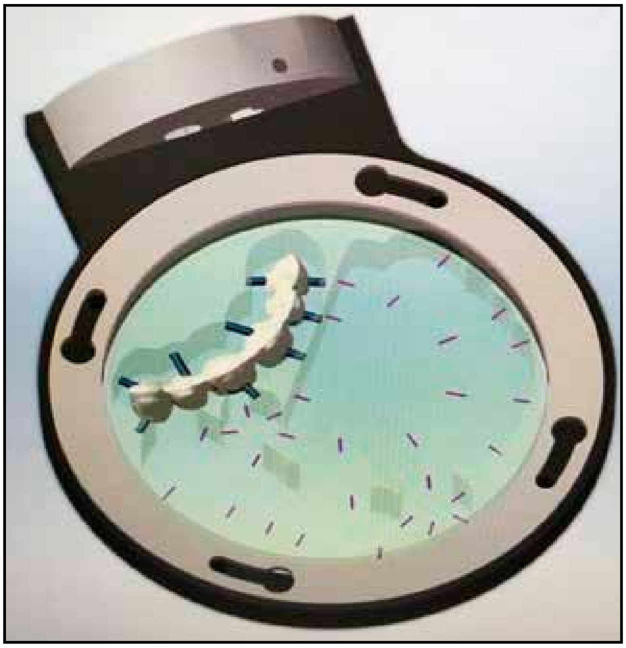

Figure 5. The virtual image of substructure is positioned on the virtual image of zirconia disk.

Figure 6. The zirconia substructure at the end of the milling process.

Figure 7. The zirconia substructure removed from de disk, before the sintering process.

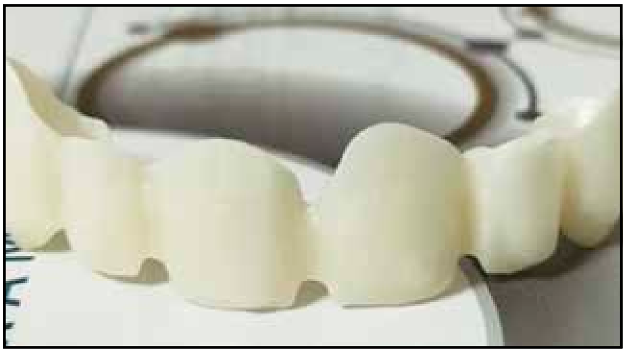

Figure 8. The zirconia substructure after the sintering process.

Figure 9. The zirconia substructure on the functional model ready to be sent to the dental office for the try-in procedure.

software (Figure 4). The type of prosthetic restoration, the preparation, neighbouring teeth and opposing teeth will be selected in the program.

Zirconium substructure design in STL format will be sent to a computerized milling centre. The structure will be projected on a zirconia disk and will be milled in 5 axes on an A1 colour disk. After computerized milling, the zirconia structure will be placed in the sintering furnace for approximately 12 hours; following this process, the material will show a contraction of approximately 25% (Figures 5 - 8).

The zirconia substructure is trimmed to fit on the functional model and sent to the dental office for the try-in procedure (Figure 9).

After the try-in procedure and the consent of the dentist, the aesthetic component will be applied on the surface of the zirconia substructure. In this particular case, the veneering material chosen was Emax (Ivoclar) ceramic material.

Figure 10. Applying of Wash on the surface of the zirconia substructure.

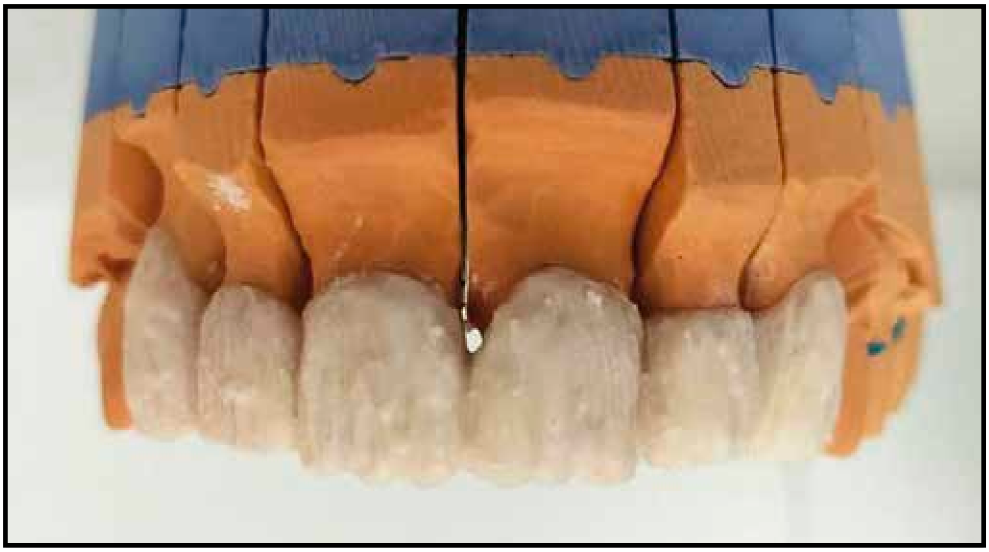

Figure 11. Applying the dentin layers of ceramic.

The zirconia substructure is intensively washed and decontaminated in chemicals with antimicrobial potential following the manufacturers' instructions, to remove any traces of saliva and blood, in the unlikely event that this procedure was not performed in the dentist's office by the staff working in the clinical department, after the try-in procedure of the zirconia substructure in the patient's oral cavity.

On the zirconia infrastructure, the dental technician applies the Wash in a thin layer, creating the foundation of ceramic structure. This layer of Wash is applied with the help of special brushes (Figure 10). The zirconia substructure is placed in a ceramic firing furnace, the process taking place at a temperature of approximately 650°C, followed by a slow cooling, to reduce the tensile stresses.

Ceramic materials are applied according to the natural structure of the teeth (dentin, enamel) to restore the shape, but also the aesthetics (Figure 11, Figure 12). All these operations are followed by the corresponding firings at temperatures between 650°C and 710°C, in specific preset programs.

The structure obtained is sent back to the specialist office, where the dentist will perform another try-in. After the completion of this clinical trial, the prosthetic restoration is sent back to the dental laboratory.

The last technical phase consists of applying the glaze layer and firing it on a temperature of 710°C. At the end of this processing phase, the prosthetic restoration on the zirconia substructure will be sent to the dental office, where the dental practitioner will cement it (Figure 13).

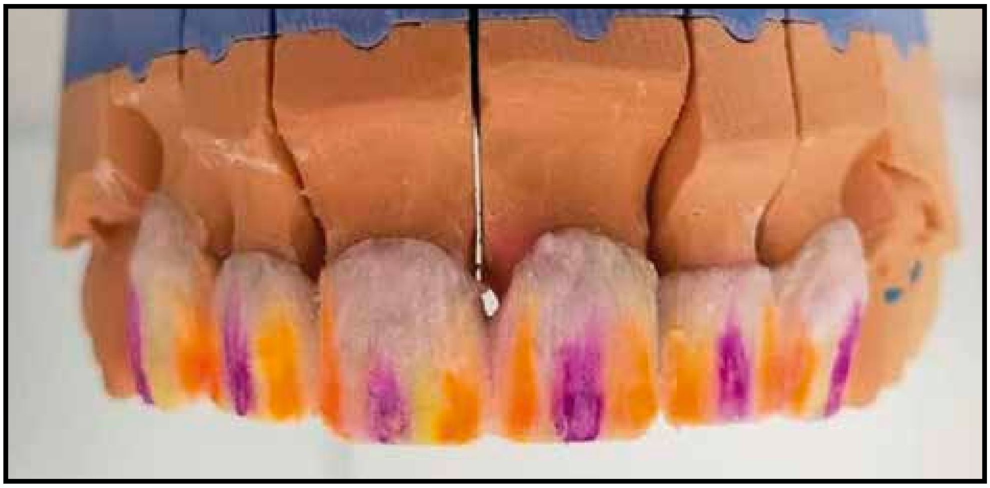

Figure 12. Contouring of special effects at the level of the restored teeth.

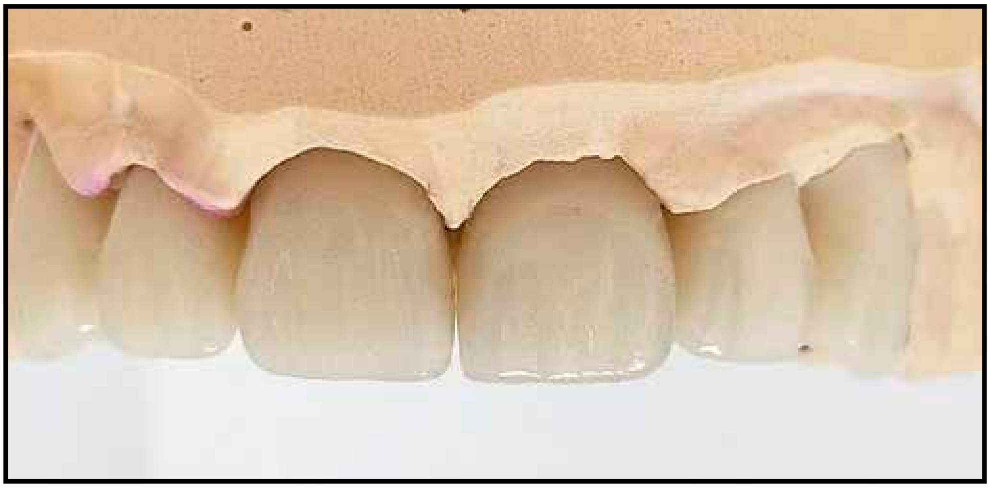

Figure 13. The final prosthetic restoration on the functional model ready to be sent to the dental office for cementing.

DISCUSSIONS

The use of zirconia in prosthetic restorations to improve the aesthetic appearance is especially aimed at the cervical area, where metal-ceramic restorations have a great deficit in the situation where the metal support can become visible over time either through gingival retraction or through transparency at the level of the gum[5,6].

As aesthetic standards are increasingly high, prevention of aesthetic accidents similar to those occurring in the use of metal-ceramic restorations is imperatively necessary[7]. The ideal treatment option would be the use of all-ceramic restorations, but not all clinical situations are suitable for such treatments[8]. The ceramic, being slightly transparent, allows the partial transmission of colours from the level of the dental abutment or the post and core used. The matte appearance of zirconia fades the colour changes at the level of dental abutments and provides a support through which the veneering of ceramic materials leads to superior aesthetic results[9,10].

Obviously, zirconia cannot be obtained under normal conditions in a dental laboratory, but only industrially in the form of discs in which prosthetic restorations or their substructure can be milled[11,12]. The process involves going through a digitized technological flow, which allows reducing errors and obtaining predictable results for each clinical situation. The human involvement cannot be neglected, the dental technician checking each technical stage using the accumulated experience and specialized knowledge[13,14].

In this way, the final prosthetic restoration restores in a natural way the morphology and functionality of the dental arch and, what is more important, the aesthetic frontal area.

CONCLUSIONS

With the help of CAD-CAM milling centres, prosthetic restorations both from zirconia substructure, but also from various dental alloys, are made much faster than the prosthetic restorations made using classic technologies. Practically, the manufacture of such prosthetic restorations, some particularly complex, can be completed even in 24 hours. Also, the materials used are in continuous development and improvement, aspects that contribute in a special way to the development of dentistry, and also of dental technique.

Aesthetic crowns on a zirconium oxide (zirconia) substructure show improved aesthetics and translucency, with the ability to preserve their properties in the long term especially in the frontal area; moreover, in the lateral area, the wear of the opposing teeth is minimal.

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