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CLINICAL ARTICLE

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A patient presentation: Planning and executing a difficult case in a full digital workflow

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Abstract

Objective: In patients requiring extensive tooth replacement, including a change of VDO and/or a new orientation of the occlusal plane, a fully digital workflow still tends to be considered too much complex to be planned and performed. This clinical report describes a full mouth rehabilitation performed with a full digital approach.

Clinical considerations: In a 50-year-old man with several missing teeth in the upper and lower arch, extensive decay on multiple teeth, severe attrition of the anterior teeth, treatment of the upper and lower arches was performed with dental implants, crowns and veneers. All prosthodontic therapy was realized with full monolithic ceramic materials (zirconia and lithium disilicate). The combination of digital information and monolithic materials enabled the clinician, the dental laboratory technician and the patient, to communicate effectively during treatment planning and to use the combination of digital workflow and monolithic materials to simplify the steps of treatment of a difficult case.

Conclusions: The combination of full digital workflow with full monolithic restorations in a full mouth rehabilitation allows a simplification of every clinical and lab step in a typically complex treatment.

KEYWORDS
full digital workflow, full mouth rehabilitation, lithium disilicate, metal free, monolithic materials, zirconia

1 | INTRODUCTION

Digital workflow with metal free materials is gaining more and more acceptance in the field of prosthodontics.[1] In the light of existing scientific evidence the use of metal free materials for fixed prosthodontic treatment is based upon clinicians own clinical experience, while taking into consideration the individual circumstances and preferences of their patients. [2] Among metal free materials, full monolithic materials are getting more and more use in fixed prosthodontics, thanks to increasing esthetic characteristics together with excellent mechanical properties. Monolithic restorations not only eliminate the risk for chipping, but also require less material thickness, show reduced antagonistic wear and simplify the fabrication process compared to veneered restorations.[3] In single units replacement obviously the esthetics of adjacent teeth requires artistic skills by well-trained technicians. In larger restorations, when multiple units need simultaneous prosthodontic treatment, multilayered monolithic materials can help to simplify the prosthetic treatment. The need to simplify workflow is especially important in complex restorations, like full mouth rehabilitations. In patients requiring extensive tooth replacement, a change of VDO, a new orientation of the occlusal plane, a fully digital workflow, without any analogic step, tends to be still considered by many clinicians and dental technicians too much complex to be planned and performed. In a standard conventional prosthetic workflow for complex restorations, attempts to achieve adequate communication with the dental technician and patient approval happen with the use of conventional diagnostic waxing, clinical trial restorations, and interim restorations. During such procedures in analogue workflows errors can occur, mainly due to several possible discrepancies in every step of treatment planning and execution. Discrepancies in the planned final restorations can cause increased treatment time, costs, and patient dissatisfaction.

On the contrary a digital workflow presents even in complex rehabilitations a predictable alternative to ensure esthetic information gathered during diagnosis and treatment adequately flows in the design, fabrication, and delivery of the definitive restorations.[4]

Fixed dental restorations fabricated from digital scans can have better marginal and internal fit than the ones fabricated from conventional impression techniques.[1]

At the same time by reducing layering steps even occlusal precision with digital monolithic may allow much better control.

2 | CLINICAL REPORT

A 50-year-old man with a noncontributory medical history presented to the dental office with the chief complaint of dental pain and unsatisfactory esthetics of his dentition. The clinical and radiographic examination revealed several missing teeth in the upper and lower arch, extensive decay on multiple teeth, severe attrition of the anterior teeth (Figures 1-4). The patient did not report any articular or muscular symptoms.

The patient had been treated with orthodontics many years ago with extraction of the upper first bicuspids, he also missed tooth 4.7, and had extensive decay affecting teeth 1.8, 1.7, 2.4, 2.5, 2.6, 2.7, 3.7, 3.5, 4.6. (Figures 5 and 6).

At the time of first consultation an intraoral scanner (TRIOS 3, 3Shape) was used to obtain an intraoral digital scan of both arches. Patient occlusion was recorded both in maximum intercuspal position (MIP), and in centric relation position (CR) (Figure 7-8). CR record was obtained through a modified Roth "power centric" technique by using hardened wax (Blue Delar).

Preliminary treatment plan focused on non surgical periodontal treatment and extraction of non restorable teeth (1.8, 1.7, 2.4, 2.5, 2.6, 2.7, 3.7, 3.5, 4.6).

After initial treatment different options with their associated risks, benefits, and costs were presented and discussed with the patient. Options included limited treatment (restoring occlusion at least to the second bicuspid, without any change in MIP), or re establishment of VDO and extensive restoration of upper and lower teeth. Due to esthetic motivation the patient elected to proceed to re-establish VDO through extensive prosthodontic treatment.

In the planning phase of treatment a virtual wax up was realized by means of a CAD software (Exocad) (Figures 9 and 10). Alignment of occlusal plane to lip and face reference was obtained by photographic means. Standardized photographs included a frontal facial view in exaggerated smile and a frontal facial view with full lip retraction were used for reference.

The virtual diagnostic waxing was milled from a polymethyl methacrylate (PMMA) block (Vipi Block Trilux, color A1), using a CAM system (Zenotec Wieland Hybrid Select). Printed models (Dreve) were used only for polishing and refinement of the mock ups.

No long term test trial with directly bonded mock ups was planned: the option to mill trial restorations from the digital files and evaluate them in the patient's mouth allowed to simplify this phase of treatment. Mock ups were tested with the patient for general esthetic

FIGURE 2 Intraoral initial clinical condition. Right side

FIGURE 1 Intraoral initial clinical condition

FIGURE 3 Intraoral initial clinical condition. Left side

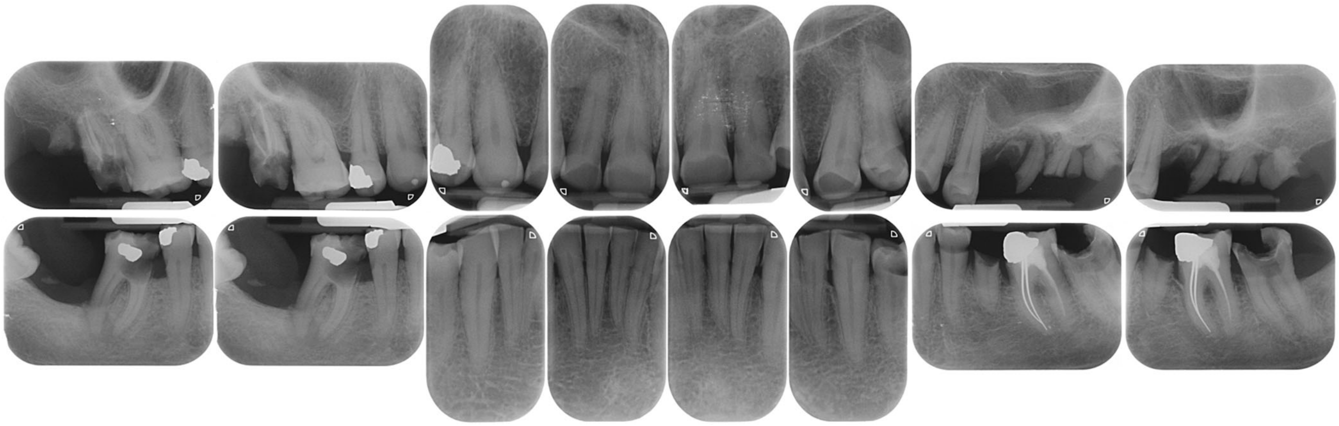

FIGURE 4 Initial radiographic examination

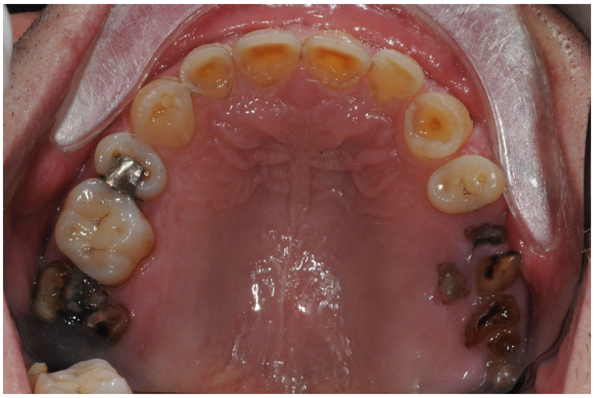

FIGURE 5 Intraoral initial clinical condition. Upper arch

FIGURE 6 Intraoral initial clinical condition. Lower arch

FIGURE 7 Intraoral scan of patient occlusion in maximum intercuspal position (MIP)

FIGURE 8 Intraoral scan of patient occlusion in centric relation position (CR)

alignment and for an evaluation of occlusal position in relation to restorative space needs (Figure 11).

After evaluation of the required restorations spaces and volumes, considering the need of a raise in VDO and of a change in the anterior position of the upper arch, full crowns were planned for the upper teeth (1.6, 1.5, 1.3, 1.2, 1.1, 2.1, 2.2, 2.3, 2.4, and 3.7 in the lower), while partial bonded restorations were planned for the lower arch (3.4, 3.3, 3.2, 3.1, 4.1, 4.2, 4.3, 4.4, 4.5). Implant supported crowns were planned for replacement of missing teeth (4.6, 3.5, 2.5, 2.6).

A provisional milled in PMMA, (Vipi Block Trilux, color A1), with a milling system (Zenotec Wieland Hybrid Select), was prepared. No model was used for preparing the provisional. In the lower arch the

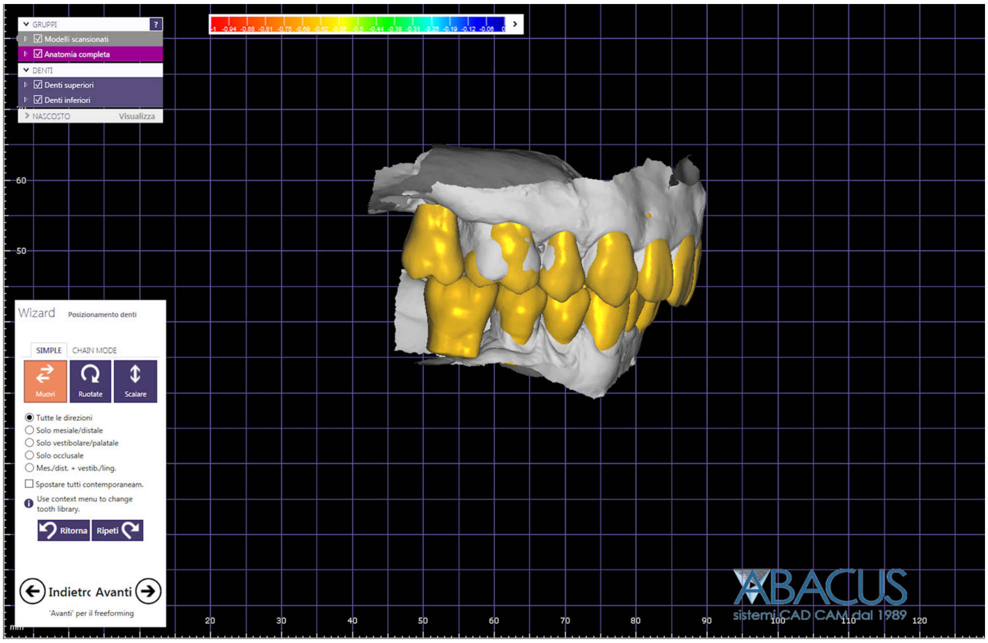

FIGURE 9 Virtual wax up. Right side

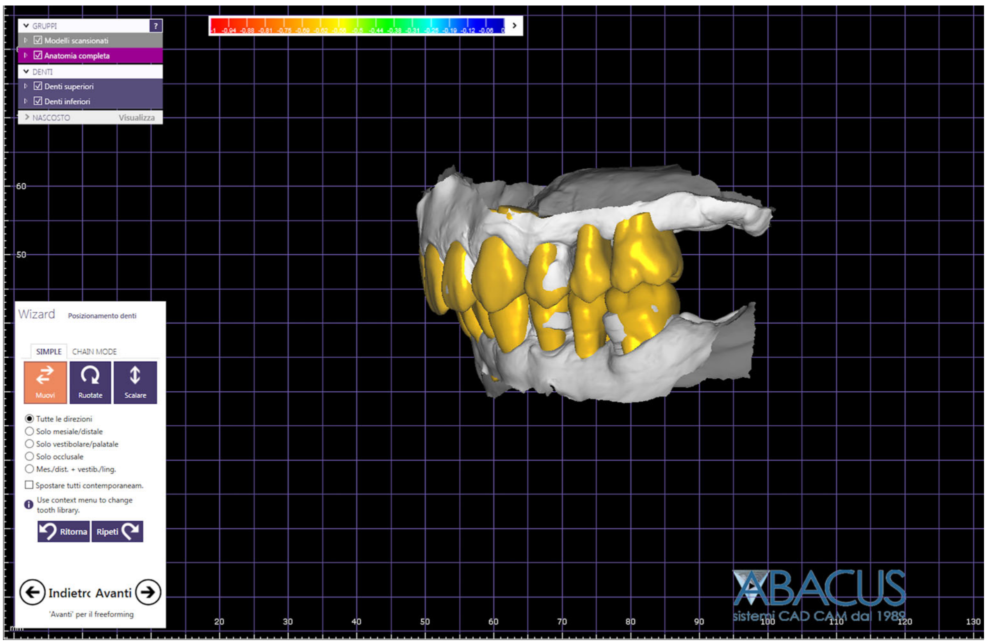

FIGURE 10 Virtual wax up. Left side

same mock up used for initial evaluation was used to raise vertical, by spot etching on the lower teeth.

Under local anesthesia upper teeth were prepared for full crowns. A feather edge type of margin was choose due to its reduction in preparation in the cervical area.[5] The lower mock up was bonded and the upper provisional was relined after tooth preparation (Figure 12).

Two weeks later the mock up was removed and lower teeth were prepared for bonded restorations. Soft tissues were checked in the upper by removing provisional restorations and show optimal healing.

Following tooth preparation, a double gingival displacement cord technique was used (size "000" and "0", Ultrapak; Ultradent). First and second cord were placed in the gingival sulcus, and a digital scan was made after removal of the second cord, using as maxillo mandibular reference position the same CR position established with the mock up (Figure 13).

After tooth preparation, the trial restorations were relined and temporarily cemented using a spot-etch technique. Veneers and bonded restorations were made with lithium disilicate (e-Max cad, HT A1), wet milled with a milling system (ZFX in House x5).

FIGURE 11 Mock ups tested for general esthetic alignment and evaluation of occlusal position in relation to restorative space needs

FIGURE 12 Upper provisional relined after tooth preparation, with lower mock up bonded

FIGURE 13 Lower teeth prepared for bonded restorations

FIGURE 14 Upper provisional with lower bonded restorations

FIGURE 15 Final digital impressions for upper arch. First and second cord placed in the gingival sulcus

FIGURE 16 Final digital impressions for upper arch. Digital scan was made after removal of the second cord

In the following appointment veneers and partial bonded restorations were delivered. The veneers were etched with hydrofluoric acid and silane. The enamel was etched with 37.5% of phosphoric acid for 15 s, restorations were inserted using dual- curing composite resin luting cement (Panavia V5, Kuraray) with ceramic and tooth primers. Occlusion was evaluated and followed by intraoral finishing and polishing.

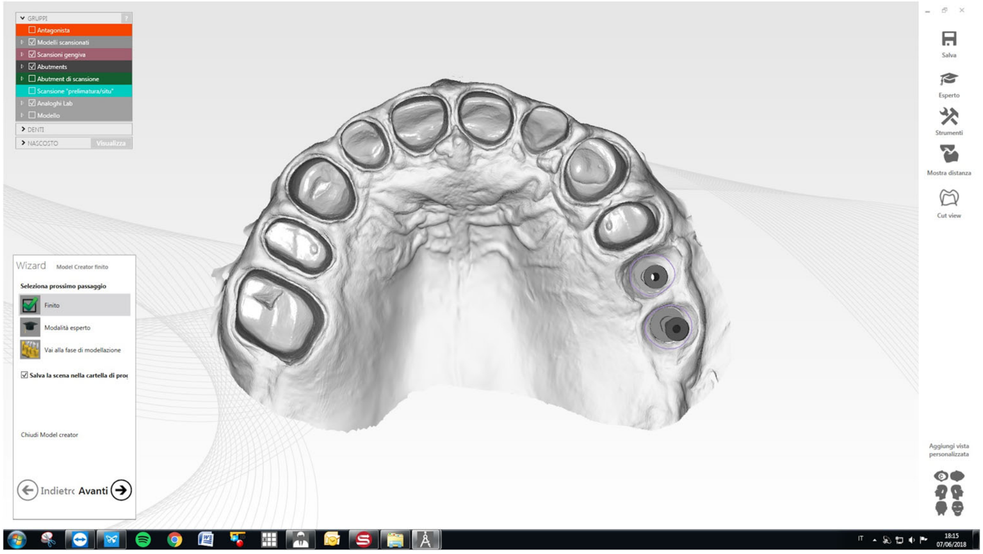

FIGURE 17 Final digital impressions for upper crowns on teeth and implants

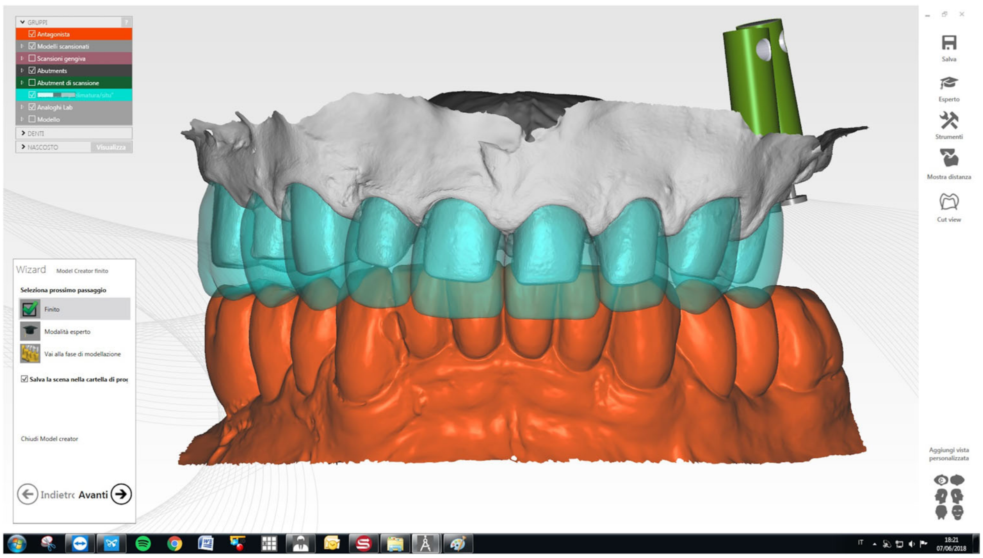

FIGURE 18 Crowns design with CAD technology

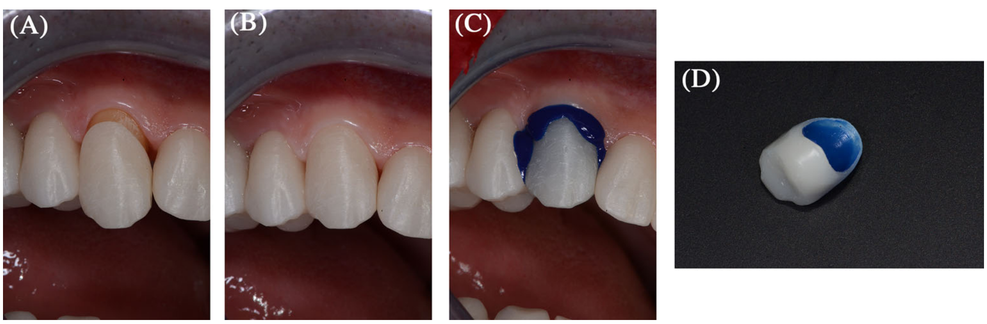

FIGURE 19 Crowns were individually tested before final refinement, glazing and polishing. (A) Crown insertion. (B) Relationship with soft tissues. (C) A colored fit checker was used. (D) Fit of individual crowns

Missing teeth were replaced with dental implants. Osteointegrated implants (Zimmer Biomet) were inserted in one surgery in position 4.6, 3.5, 2.5, 2.6. In the upper arch a simultaneous sinus augmentation with Summers technique was performed at the time of implant placement.

After 2 months healing in the lower and 3 months in the upper, implants were loaded with provisional restorations for approximately 1 month (Figure 14). Impressions for implant supported provisional restorations were taken with intraoral scanner and scan abutments. Provisional restorations were milled in PMMA, (Vipi Block Trilux,

FIGURE 20 Final restoration individualized by staining and glazing

FIGURE 21 Intraoral final clinical condition

color A1), directly to the fixture level with a milling system (Zenotec Wieland Hybrid Select).

Final digital impressions were taken simultaneously for upper and lower crowns on teeth and implants. A double gingival displacement cord technique was used (size "000" and "0", Ultrapak; Ultradent). First and second cord were placed in the gingival sulcus, and a digital scan was made after removal of the second cord (Figures 15-17). Maxillo mandibular reference position achieved by means of mock up and provisionals was used for final restorations.

Crowns were then designed using CAD technology (Exocad), (Figure 18), milled in multilayered monolithic zirconia (Zirconia Katana STML in the posteriors, UTML in the anteriors, color Vita A1), with a milling machine (Zenotec Wieland Hybrid Select), sintered in a sintering oven (Multimat 2 Sinter, Sirona) with a 1500°cycle for 2 h with a heating and cooling rate of 5° per minute. Implant crowns were milled in zirconia (Katana ML, color A light) with a milling machine (Zenotec Wieland Hybrid Select).

All the crowns were tested before final refinement, glazing and polishing (Figure 19). Extremely limited occlusal adjustment was needed.

After try-in the restorations were individualized by staining and glazing (Cerabien FC Paste Stain Kit, Noritake) (Figure 20).

FIGURE 22 Intraoral final clinical condition. Right side

FIGURE 23 Intraoral final clinical condition. Left side

FIGURE 24 Patient smile

Teeth-supported restorations were inserted for final cementation using dual- curing composite resin luting cement (Panavia V5, Kuraray) following airborne-particle abrasion, and the screw channel of 4.6, 3.5, 2.5, 2.6 were sealed using Teflon tape and a composite (Tetric EvoCeram, Ivoclar Vivadent).

Occlusion was evaluated and followed by intraoral finishing and polishing.

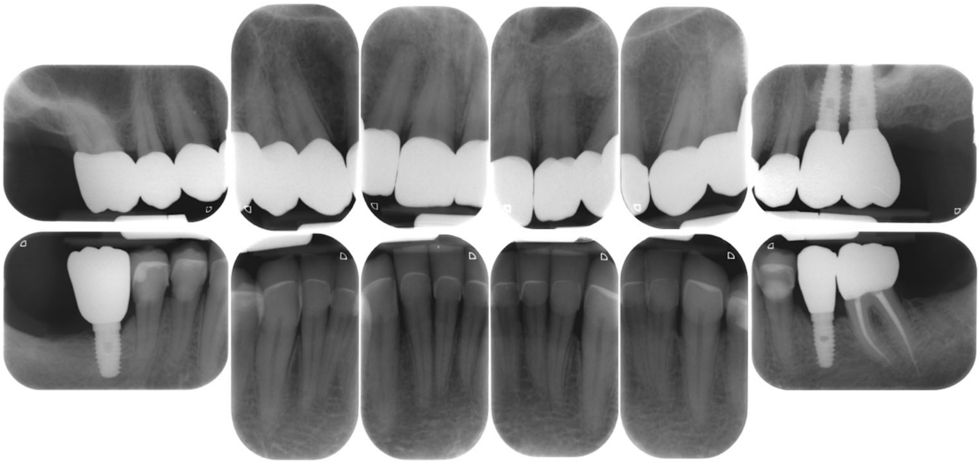

FIGURE 25 1 year follow up X-rays

The patient was checked after 1 week (Figures 21-24), later inserted in routine follow ups. After 1 year routine photographs and x rays were performed (Figure 25).

DISCLOSURE

The authors do not have any financial interest in the companies whose materials are included in this article.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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