

Esthetic Restorations in the Digital Workflow for Everyday Practice

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Digitalization for the dental office and the laboratory requires both significant time and financial outlay. In addition, the time and the effort spent on learning must also be considered. Clinicians and technicians who digitize their practice must carefully evaluate the real advantages that it can bring in terms of superior clinical outcomes, predictability, use of innovative materials, communication with the patient and with the laboratory and the possibility of sharing information between different specialists.

Those who approach digitalization to optimize their investment should understand that it is the beginning of a path that requires a change of mentality: a scanner is not just a tool to take an impression, rather a powerful data acquisition tool. Clinicians should learn how to use and to correlate intraoral files with other data, both radiographic, photographic and functional data, through dedicated software in order to maximize the digital experience.

In the aesthetic area, the digital workflow enables the eventual prosthetic outcome, with numerous smile design programs to be presented to the patient in advance of treatment initiation. It also allows for the creation of restorations using new materials that combine minimal invasiveness with the ability of being milled, thus perfectly reproducing the desired anatomies and the aesthetic results.

The greatest concern of clinicians and technicians in the realization of aesthetic restorations is the vestibular aspect of the teeth, often neglecting the palatal part of the anterior teeth which plays a fundamental role in mastication, parafunctional movements, speech and function ⁽¹⁾. Correct and physiologic static and dynamic contacts of anterior teeth guarantee the correct functioning of the masticatory system and the long-term balance of what has been achieved with the restorations.

To understand how digital workflow can also be powerful from this point of view, it is worth reiterating that the shape of the palatal side of the anterior group is what

guarantees the neuromuscular function of the anterior guide and the freedom of movement to the mandible; it shows great variability. It is therefore characteristic of each individual and cannot be standardized or measured with functional records ⁽²⁾.

The possibility of digitalizing the functional part of natural teeth that have to be restored, or of old restorations to be replaced, or even of functionalized provisionals, allows the perfect reproduction of the palatal side in the milled product. The use of monolithic materials, which can be layered in the vestibular part if indicated, allows great resistance of the restoration even at reduced thicknesses ⁽³⁾, with biological advantages that improve the long-term prognosis of the tooth-prosthetic assembly.

It has been demonstrated that the digital workflow allows for high-precision restorations ⁽⁴⁾ and that new materials provide high guarantees of aesthetics and long-term prognosis if properly selected and applied. The correct treatment of the periodontal tissues and the clinical management of the preparation, impression, try-in and cementation phases must be followed with the digital workflow in order to achieve optimal results for aesthetics, function and long-term prognosis.

In everyday clinical practice, the workflow for the treatment of a restorative case in the aesthetic area should include: preliminary scans, photographic series, case study, setting of aesthetic parameters, wax-up, insertion and functionalization of provisionals, scan of the wax-up or of functionalized and adapted provisionals and realization of final restorations. With the digital workflow, in addition to the functional aspects, it is also possible to copy the anatomy of the pontics, as well as the connective path of implant restorations, to maintain support for the connective tissue obtained through the provisionals.

The following three cases demonstrate the use of digital technology in restoration of simple everyday cases in a dental practice.

CASE 1 (Figures 1-6)



Fig. 1 : Case 1, initial situation



Fig. 2 : Occlusal view, it is evident the partial anchorage on tooth #11 with an underlying decay



Fig. 3 : Edentulous saddle modification



Fig. 4 : All the intraoral digital files can be matched to copy anatomic and functional details



Fig. 5 : The incisal guidance is the perfect copy of the natural teeth



Fig. 6 : Provisionals and final zirconia restoration

The first clinical case is of a female patient who presents for replacement of the old prosthetic restoration for aesthetic and biological reasons. The metal border of the crown on the 13 disturbed the patient and there was secondary caries at the 11 resulting in pulpal necrosis and root resorption, which made extraction of the 11 necessary. The 21 required replacement of old composite restorations and the 22 was endodontically treated, discolored and heavily restored.

The patient was a 48-year-old woman with an occupation which required her to travel continuously and she was particularly anxious about dental treatment. She

refused implant therapy because it would have involved multiple interventions to regenerate the heavily resorbed edentulous site.

After consideration of several treatment options, the treatment plan agreed upon was a fixed prosthetic restoration from 13 to 22, using a multilayered zirconia with vestibular ceramization and monolithic palatal side.

The patient has an extremely high smile and this made the case particularly critical, determining the need to increase the tissue in the edentulous site of the 12 and to wait for the healing of the extraction socket of the 11

CASE 2 (Figures 7-12)

because a deficit of the edentulous spaces would have led to an evident and impairing aesthetic problem.

The pre-milled provisional restoration was CAD-CAM fabricated, reproducing the scan of the initial situation, which in terms of the shape of the teeth and from the functional point of view was congruous. The management of the edentulous spaces had been planned to achieve the integration of the intermediate elements in order to camouflage the absence of the teeth.⁽⁵⁾

Once the tissues were stabilized and perfect integration of the provisionals was obtained, it was possible to proceed with the digital impression, starting with scanning of the provisionals. Having the file of the provisional to be copied with the final restoration allows the thicknesses of the prepared teeth to be checked and to perfectly duplicate the palatal part of the restoration that will be realized in non-layered monolithic material. The advantage of making the functional surfaces in monolithic material has been demonstrated. The benefits of using a monolithic material include minimal thickness of tooth removal and minimal wear of the opposing dentition⁽⁶⁾.

A challenge in this situation was to perfectly harmonize the healthy left canine, as this tooth was not included in the restoration, with the final prosthesis. The final prosthetic phase was completed in three clinical sessions which included the digital impression, aesthetic tooth try-in followed by cementation. In addition to the various digital scans, the photographs of colour selection and those of the try session were sent to the laboratory to optimize the aesthetic outcome.



Fig. 7 : Case 2, initial situation



Fig. 8 : The edentulous space after conditioning



Fig. 9 : Provisional restoration functionalized

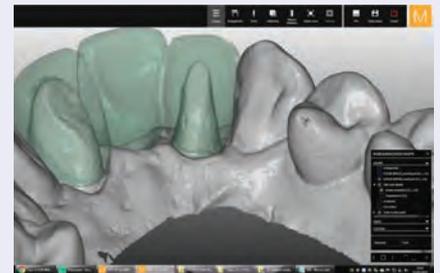


Fig. 10 : The matching of functionalized provisionals with the final impression allow to reproduce form and function



Fig. 11 : The shape of ovoid pontics will be copied in the final restoration by scanning the gingival side of the temporary restoration



Fig. 12 : Final restoration in multilayered zirconia

The patient presents with a failing 3-unit cantilever fixed partial denture due to secondary caries. The treatment plan established for this patient was a conventional fixed partial denture. This involved conditioning the edentulous saddle area to achieve ideal soft tissue contours. The material selected, considering the severe discoloration of the 11 abutment, was a multilayered monolithic zirconia with a high value to camouflage the discoloration. The palatal aspect of the prosthesis was left in a monolithic material up to the incisal edge, and a minimal amount of ceramic was applied only on the vestibular side.

A preliminary scan was utilized to fabricate a milled PMMA provisional restoration which supported the contours of the newly developed saddle area with an ovoid shaped pontic.

Once the edentulous saddle was stabilized, the idealized provisional was scanned and used as a guide for fabrication of the definitive prosthesis. In addition, the abutment teeth and gingival contours were recorded in the final digital impression. This information was utilized to fabricate the new fixed partial denture.

CASE 3 (Figures 13-19)



Fig. 13 : Case 3, initial situation and smile design



Fig. 14 : Mock-up, once adjusted and approved it is scanned



Fig. 15 : Preparation of the mock-up and gingival retraction with cords



Fig. 16 : The occlusal contact set by the scanner are compared with an intraoral picture with marked occlusal contacts. The file from the mock-up is matched with the final impression to check the spaces and setting the final restoration

This young patient presents with fracture of the incisal edges of 21 and 22 and multiple cracks of the vestibular enamel following traumatic injury. After a very simple digital smile design that was communicated to the patient, it was decided to restore the anterior teeth with porcelain veneers. The photographs and the simulation were sent to the laboratory to set up the virtual wax-up on which to print the model.

A silicone index was printed on the model which was utilized for fabrication of a direct composite mock-up. The patient had the opportunity to wear this composite mock-up for several days in order to adapt and assess the new clinical situation.

The patient reported that she was pleased with the functional and esthetic aspects of the composite mock-up. As such, the mock-up was scanned and utilized as the pre-preparation scan which was used to establish the contours of the final restorations. The teeth were prepared through the composite mock-up. This technique allows for more conservative tooth preparation, as the restorations were completely additive in some aspects, thus eliminating the need for uniform tooth reduction.

Once the preparations were completed, a digital scan of the abutment teeth was carried out and matched with the pre preparation scan of the mock-up. The porcelain veneers were milled out of lithium disilicate and characterized by the laboratory technician

Adhesive cementation was performed with isolation of the operating field by means of a rubber dam. The minimal preparation and maintenance of the finishing line within enamel allows for maximum adhesion and overall strength of the restorations.

CONCLUSION:

These three simple cases which represent everyday dentistry demonstrate the following advantages of a digital workflow:

- Digital technology allows for predictable reproduction of a pre-clinical situation. This minimizes “guess work” as the patient has the opportunity to test the



Fig. 17 : Cementation with rubber dam under microscope



Fig. 18 : Clinical control after 1 week from veneers luting



Fig. 19 : Final restoration

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restorations at the provisional stage, and once established, the provisionals can be predictably duplicated for the final outcome.

- The use of materials that can be milled at minimum thicknesses, high flexural strength and high esthetics allows for conservative preparations with minimal biological impact.
- The digital workflows should be introduced into the clinical workflow in a systematic way. It is advisable for clinicians to familiarize themselves with various diagnostic softwares in order to optimize both simple and complex cases.
- The dental laboratory technician is a fundamental partner for the restorative dentist and digital tools allow for ease of communication between the technician and clinician which ultimately yields ideal outcomes. ■

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About the author



Dr. Costanza Micarelli received her dental degree from the University "La Sapienza" of Rome (Italy). Her practice is focused on Fixed Prosthodontics and Temporomandibular Disorders. She is a full member of the European Academy of Craniomandibular Disorders, Active Member of AIOP (Italian Academy of Prosthetic Dentistry) and Elected President of AIOP in 2021. Dr. Micarelli is an Adjunct Professor in the International Master of Prosthodontic Sciences, University of Siena and an Adjunct Professor in the Master in Esthetic Dentistry, Goethe University Frankfurt am Main. She is the Founder and 2022 President of the Italian Society of Prosthodontics and Oral Rehabilitation (SIPRO) and the very proud mother of Cecilia and Benedetta