Digital work-flow introduce a novel approach for a predictable rehabilitation using patient’s intra and extra oral photo, virtual diagnostic wax-up, intra-oral scanner and CAD-CAM production. The first step of a digital work-flow is the virtual diagnostic wax-up build up from the patient’s photos for the aesthetic’s planning using the digital smile’s technology. Digital smile’s method allows a simplified aesthetic diagnosis and makes more effective the communication with patients thanks to the restoration’s preview. Once validated the simulation of the rehabilitation and then validated the preparation, final manufacturing will be create using CAD-CAM technologies. The initial step of the highly precise digital work-flow is an analogue impression (1) so an intra-oral scanner is used to record the two arches. Conventional high precision impression materials offer a well know procedure to transfer the clinical situation into the laboratory (2), however are prone to dimensional changes due to on-going chemical reaction (3) and stone will show expansion due to secondary reaction whilst setting (4). The potential distortion of the impression due to limited suitability for storage, deficient dimensional stability, disinfection in antiseptic solution, partial or extensive separation of the impression material from the tray, transport into the dental laboratory at different climatic conditions and the overall long process chain has to be mentioned (5). Additionally, the choice of the impression technique seems to influence the accuracy of dental impressions, hence the fitting of the resulting restorations (6). Besides, discomfort for the patient like sweating, gagging, pain and partially inconvenient taste is a know issue associated with conventional impression taking. The conventional impression requires many critical steps that can be skipped when using digital impression. This technique can reduce the chair time including the tracks selection, impression, cost setting time, disinfection of the cast and transport to the laboratory (7). This critical steps might be avoided by direct data capturing, which represents a logical direct access to dental CAD-CAM (8). Accurate impressions represent an important prerequisite for precise dental restorations and intraoral digital data capturing seems to be a logical step to prevent the
possible errors already at the very beginning of the
digital work-flow (9). The accuracy of intra-oral
scanner has been determined by several authors
(10). This modern technology has progressively
been getting more and more attention in the dental
field, has it increases the comfort of the patient and
minimizes risks of distortions during the impres-
sion process (11). Direct acquisitions systems have
been constantly improved because this are less in-
vasive, quicker and more precise than the conven-
tional methods (12). Besides the digital image can
be easily store for a long time (13). Digital impres-
sions offer benefits to both clinicians and patients.
Patients are spared from need for any contact with
messy impression material, those with strong gag
reflexes may particularly benefit from the digital
technology because the scanner do not touch the
soft palate. These are used for a briefer interval
than impression trays and allows patients to take a
break if necessary (14). So the use of intraoral digi-
tal scanner has the potential to simplify the task of
obtaining impressions (15). After taking the digital
impression, clinical can do the web order: scanning
are sent, throughout a digital way, to the laborato-
ry. Using the virtual wax-up and the scanning, the
laboratory proceeds with computer-aided design/
computer-aided manufacturing (CAD-CAM) pro-
duction. The application of CAD-CAM restora-
tions provides innovative, state-of-the-art dental
service, and its application was increased signifi-
cantly in the last years. CAD-CAM dentistry uti-
lize a computer design prosthetic structure that will
be mechanically milled (CAM). This technology
changes from the conventional manual process with higher quality, standardized steps and lower
cost. So after the data acquisition, a processing
software creates the virtual restoration (virtual
mock-up). Once validated the virtual or physical
mock-up by the clinical, the laboratory can pro-
cceeds with CAM production.

Methods

To present step by step the digital work-flow, a
clinical case was chosen that required four implant
restoration and four zirconia solidid zir lumnia ez
crowns for the replacement of teeth 11-12-21-22, a
zirconia solid zir lumnia ez crown for the rehabili-
tation of 13, and a lithium disilicate veneer for the
rehabilitation of 23. The patient is a 55-year-old
woman asking for aesthetic improvement of the
smile and the closure of the diastema between the
maxillary central incisors. At first, a photo of the
patient’s smile was taken (Fig. 1). Using the digi-
tal smile technology it was possible, from that pho-
to, to obtain a virtual wax-up of the final restora-
tion by making a cutout of the original teeth (Fig.
2). The virtual wax-up offers important advantages
to the clinician and to the laboratory and allows an
efficient planning of the work. First, it is immedi-
ately available and it can be directly used to build up the final dental prosthesis allowing a saving of
cost eliminating the manual reproduction of the
project by the laboratory. Second, it offers the possibility to the patient to have a personal and extremely realistic view of what would be the resulting smile after rehabilitation. Once the diagnostic project has been accepted by the patient, the insertion of 4 implants in seat 11-12-21-22 and the prosthetic preparation of the 23 and 13 were performed. After four months, a direct digital impression was taken using an intraoral scanner to register the two arches and the right occlusion. To take the impression was used the 3mlavacos intraoral digital scanner and intraoral implant scan bodies, to take the oral scan was also used a powder scan spray to make better the image resolution (Fig. 3).

Important to note, it took only 2 minutes without any problems relating to gag’s reflex and it prevents organoleptic’s bothers in the patient. The virtual model (Fig. 4) was sent through a digital way to the laboratory, which proceeded with the CAD-CAM production. The virtual modeling was performed using 3shape design’s software. The CAD project (Fig. 5) was developed using the virtual wax-up of the final restoration as a model. After validated the laboratory work, it could be possible to proceed with the CAM modeling and the production of the final prosthesis (Figs. 6 a, b). At the third and last appointment took place the finaliza-
Results

The digital work-flow, taking advantage of wax-up, digital impression, mock-up and CAD-CAM production, facilitates the communication between clinical, patient and laboratory. Diagnostic wax-up are an efficient tool for the prosthetic planning, because they give an immediately preview for the dentist and the patient and because they can also be use directly for the planning of the final restoration. Direct data capturing reduces patient’s discomfort and ensure a better adaptation of the prosthetic by removing disorders associated with gag reflex and issues related to the impression material deformation. CAD-CAM technologies offers the opportunities to visualize three dimensional image of the prosthetic to easily speak with laboratory about clinical cases. More over CAD-CAM enables more rapid production’s times and less production’s cost.

Conclusions

Combining virtual wax-up and digital with CAD-CAM technology enables a dramatic compression of the time required to deliver a final prosthesis. The digital work-flow is a new predictable opportunities for the prosthetic team. Digital work-flow allows a simplify work-flow and a reduction in the number of appointment. In confront of traditional method, the digital work-flow seems to be a more rapid, precise and comfortable solution, with better clinical results.

References

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