Full digital rehabilitations on implants with TDC® technique: case series

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Abstract

Objective: This study aims to present a fully digital protocol—Total Digital Concept (TDC®)—for immediate loading full-arch implant rehabilitation utilizing a prefabricated definitive prosthesis, thereby eliminating the need for provisional restorations and reducing treatment time.

Materials and Methods: A case series involving patients with terminal or edentulous dentition was treated using the TDC® workflow. The protocol integrates advanced digital technologies, including intraoral scanning, facial analysis, virtual diagnostic wax-up, and CAD/CAM manufacturing. Based on STL data from digital wax-ups aligned with 2D facial photography, implant planning was prosthetically driven. Surgical guides and final prostheses were fabricated preoperatively. Implants were placed using a fully guided approach, and definitive screw-retained prostheses were delivered within the same surgical session.

Results: The digital-to-clinical translation showed high accuracy, allowing immediate delivery of pre-fabricated definitive prostheses without modification. No intraoperative complications occurred, and postoperative follow-up at 1, 2, 6, and 12 months confirmed the stability of both implants and prostheses. Patient satisfaction was high due to minimal appointments and immediate functional and aesthetic outcomes.

Conclusions: The TDC® workflow demonstrates that full-arch implant rehabilitations with immediate loading and delivery of definitive prostheses are clinically feasible through a digital approach. This technique offers enhanced efficiency, precision, and patient satisfaction. However, despite its promising outcomes, current scientific evidence on fully digital full-arch workflows remains limited. Further clinical trials must validate its long-term predictability and broaden its applicability in routine implant practice.

Keywords: Full-arch rehabilitation; Immediate loading; Digital workflow; Total Digital Concept (TDC®); Implant-supported prosthesis; Pre-fabricated definitive prosthesis; Guided surgery; CAD/CAM; Edentulism; Implant dentistry.

Introduction

Full-arch immediate loading implant rehabilitation is currently considered a particularly valid treatment modality for edentulous patients or those with terminal dentition (1,2). By inserting a variable number of implants, typically between four and six, and subsequently fabricating and delivering a screw-retained full-arch provisional prosthesis, both functional and aesthetic restoration of the entire arch can be achieved within 24 to 48 hours postoperatively (3,4). According to the literature, this type of

implant-supported prosthetic rehabilitation is regarded as a predictable treatment, with ten-year survival rates exceeding 90% (5,6). Nonetheless, this therapeutic approach is not exempt from complications (7,8), and ongoing research focuses on prevention strategies and protocol optimization.

In recent years, dentistry has undergone a profound transformation driven by the evolution of digital technologies (9). This revolution has significantly influenced diagnosis, treatment planning, prosthetic fabrication, and surgical procedures. Tools such as intraoral scanners (10), implant planning software (11), facial scanners (12), mandibular registration systems (13), and CAD/CAM (14) manufacturing technologies have enabled the development of fully digital rehabilitative workflows (15,16)

Initially, applying such workflows in full-arch implant therapy faced limitations (17,18), mainly due to data acquisition challenges in edentulous patients. The absence of natural reference points like teeth made registration and data alignment complex (19). However, technological advancements and research efforts have led to the development of several innovative digital approaches.

Among them, the Total Digital Concept (TDC®) stands out as a novel method that integrates exclusively digital tools from initial data collection to the delivery of the definitive prosthesis. Unlike conventional workflows that rely on provisional prostheses and multiple appointments, the TDC® protocol enables immediate loading with a pre-fabricated final prosthesis. This article aims to present a series of clinical cases illustrating the application of TDC® in immediate full-arch implant rehabilitation.

Materials and Methods

A female patient, aged XX, with no significant medical or pharmacological history, presented with terminal dentition and functionally and aesthetically compromised arches. Initial assessments included clinical examination, photographic documentation, panoramic radiograph, cone beam computed tomography (Kavo OP3D), intraoral scans (Trios 3Shape), and shade selection.

The agreed treatment plan involved full-arch immediate loading using the TDC® protocol. The digital workflow commenced with a virtual wax-up based on intraoral scans and facial photographs, collaboratively developed between clinician and technician using 3Shape Dental System software. The virtual smile design was aligned with 2D facial images through manual referencing, resulting in a 3D STL file used for mock-up fabrication. The wax-up was printed in-office with an Asiga 3D printer using Keystone Model resin. A rigid silicone index transferred the digital design intraorally using auto-polymerizing composite resin (e.g., ProTemp 3M, Luxatemp DMG), allowing aesthetic evaluation. Upon approval, the data were used to guide implant planning in 3Diemme RealGuide.

Implant positioning was prosthetically driven. Six Prama Power implants (Sweden & Martina) per arch were virtually planned for optimal alignment in all axes, particularly in the Z-axis, for emergence profile control. Final designs were sent to the HD Dental Laboratory to fabricate a double-structure prosthesis (titanium substructure and multi-layer composite veneering).

Surgical procedures were guided and fully digital. The remaining teeth were used for guide stabilization. After extraction and osteoplasty, implants were placed using guided mounts, and the definitive prosthesis was delivered and torqued to 30 Ncm. Flaps were sutured, and healing occurred under prosthetic guidance.

Follow-ups were scheduled at 1, 2, 6, and 12 months. Between insert dates], N cases were completed with TDC®, as summarized in Table 1.

Results

All prostheses demonstrated excellent fit without requiring intraoperative adjustments, confirming the precision of the digital workflow. Implant placement and prosthetic fit matched the virtual plan, and immediate loading was successfully achieved.

Throughout the follow-up period, no biological or mechanical complications were observed. Implants remained stable, and the definitive prostheses showed no fractures, loosening, or occlusal issues. Soft tissue healing proceeded predictably.

Patients reported high satisfaction due to the reduced number of visits and the immediate aesthetic and functional outcomes. Between insert dates], N full-arch rehabilitations using TDC® were performed consistently across all cases.

Discussion

The TDC® workflow offers a promising advancement in digital implantology. It allows for immediate delivery of a definitive prosthesis without provisional phases. Unlike conventional protocols requiring secondary impressions and multiple steps, TDC® integrates diagnostics, planning, surgery, and prosthesis delivery into a single, continuous digital process.

This prosthetically driven approach repositions the dental technician as a proactive partner in treatment planning, fostering synergy between clinical and technical disciplines. Simulating surgery and prosthetic fit in advance eliminates intraoperative uncertainty and enhances procedural predictability.

While previous literature has explored digital techniques, no studies have examined workflows involving immediate delivery of pre-fabricated definitive prostheses. Most existing publications focus on individual digital components or temporary restorations (19-22).

Current research trends are divided into two directions: high-tech, integrated workflows aiming to reduce appointments and lower-cost solutions involving more steps. Although promising, the TDC® approach belongs to the former and requires further clinical trials to validate its outcomes (23-27).

Initial situation

DSD outcome
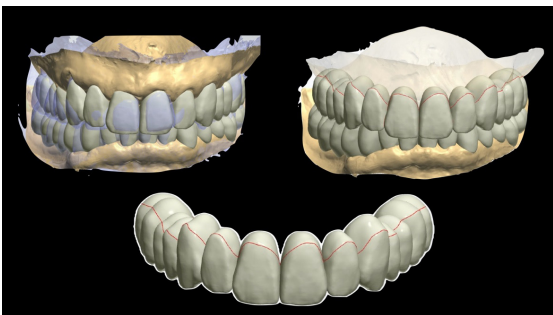
Design of the final prosthetic project based on DSD
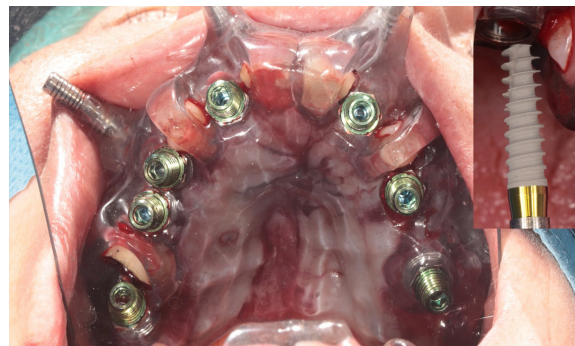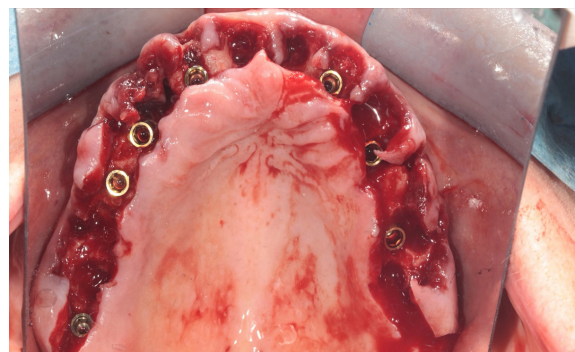

Definitive prosthesis

Pre-implant extractions with preservation of surgical guide support elements
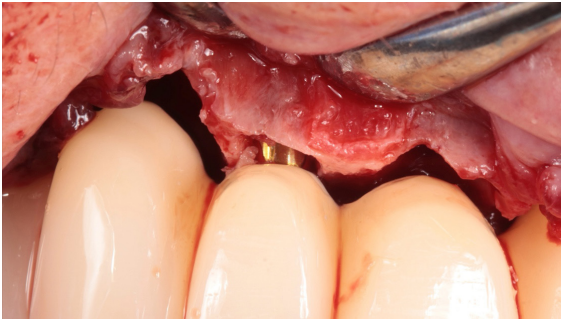

Surgical guide correctly positioned
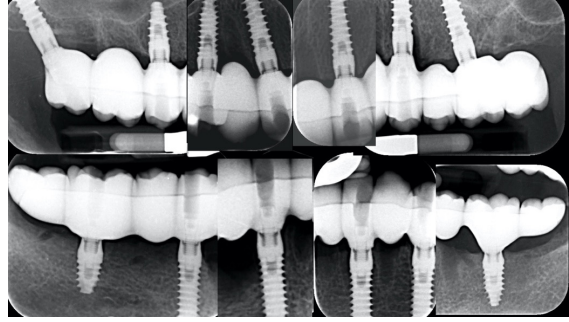

Implants in situ

Pre-screw-retention phase of the prothesis

Prosthesis screw-retined to implants

Detail of the prosthesis-implant connection

Postoperative periapical radiographs

Final outcome-occlusal view

Before and after

Conclusions

Despite limited scientific evidence, the findings presented in this case series indicate that full-digital workflows are viable for immediate full-arch implant rehabilitation. The TDC® protocol, in particular, demonstrates clinical feasibility, high precision, and strong patient acceptance.

However, the definitive validation of this approach requires additional prospective studies and long-term data. If confirmed, the TDC® workflow could redefine clinical standards in implant prosthodontics by offering an efficient, accurate, patient-centered alternative to traditional methods.

Final outcome – frontal view

Table 1. Patients table

Name	Age	Sex	Medical History	Maxilla (Upper Arch)	Mandible (Lower Arch)	Passive Fit
Isoni Rita	60	Female	Smoker, hypertensive	6 implants	8 implants	Lower (complete), Upper (increased resistance)
Marras Alessandra	57	Female	No relevant systemic conditions	8 implants	5 implants	Not specified
Sanna Filomena	65	Female	Controlled hypertension, hypothyroidism	6 implants	6 implants	Not specified
Iacchetti Teodoro	83	Male	Ischemic heart disease, hypothyroidism, four bypasses, hypertensive	6 implants	N/A	Upper
Matta Massimo	61	Male	No relevant systemic conditions; heavy smoker and drinker	N/A	6 implants	Lower
Domenicucci Walter	Not specified	Male	Not specified	6 implants	6 implants	Not specified

Patients table

Patient	Age	Gender	medical history	Implant Treatment
PR	66	F	High Blood pressure	Upper Full arch with 7 implants
				Lower Full arch with 6 implants
FG	67	F	None	Upper Full Arch with 6 implants
				Lower Full Arch with 4 implants
AR	84	F	hypothyroidism	Lower Full Arch with 6 implants
OG	66	M	High Blood Pressure	Upper Full Arch with 6 implants
				Lower Full arch with 6 implants
CA	74	M	Type 2 Diabetes	Upper Full Arch with 7 implants
CA	72	F	High blood pressure	Lower Full Arch with 6 implants
UA	74	F	Rheumatoid arthritis	Upper Full Arch with 6 implants
LL	48	M	None	Upper Full Arch with 6 implants
MP	53	F	None	Upper Full Arch with 6 implants
IR	60	F	Light smoker	Upper Full Arch with 6 implants
				Lower Full Arch with 8 implants
MA	57	F	None	Upper Full Arch with 8 implants
				Lower Full Arch with 5 implants
SA	65	F	High blood pressure	Upper Full Arch with 6 implants
				Lower Full Arch with 6 implants
IT	83	M	Previus heart disease	Upper Full Arch with 6 implants
MM	61	M	Smoking and drink Alchool	Lower Full Arch with 6 implants

Conflict of Interest Statement

The authors declare no conflict of interest.

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