ARTICLES SCIENTIFIQUES

Digital Impression for Implant-Supported Fixed Prosthesis: Protocol Insights and Clinical Interest

Empreinte numérique pour prothèse fixée implanto-portée : protocole et intérêts cliniques

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Résumé

Introduction : La technologie d'empreinte numérique a révolutionné la prosthodontie implanto portée en offrant une alternative plus précise et confortable pour le patient. L'objectif de ce rapport est d'illustrer le protocole clinique et les résultats d'une approche entièrement numérique pour la réalisation de restaurations fixes implanto-portées. **Observation clinique** : Une femme de 45 ans, en bonne santé, s'est présentée avec l'absence de la 15 et la 16 et souhaitait des solutions prothétiques fixées. Après une évaluation clinique et radiographique, deux implants ont été placés. Le plan prothétique prévoyait deux couronnes transvissées en zircone monolithique, entièrement fabriquées via un flux de travail numérique. Le scan intraoral des scan bodies, la conception CAD/CAM et l'usinage ont été réalisés sans recours aux matériaux d'empreinte. **Discussion** : Le flux de travail numérique a simplifié les procédures tant au fauteuil qu'au laboratoire, réduisant le temps et améliorant l'efficacité par rapport aux méthodes traditionnelles. Les empreintes numériques ont fourni des résultats fiables et reproductibles pour les restaurations implanto-portées de courte étendue. Cependant, la précision peut être influencée par le système de numérisation, le design des scan bodies et la dépendance à l'opérateur. **Conclusion** : Les empreintes numériques permettent la réalisation de restaurations implanto-portées précises et esthétiques tout en offrant confort et efficacité. Toutefois, elles présentent encore des limites, notamment pour les restaurations sur arcades complètes, et demeurent dépendantes de l'opérateur.

Key words : scanner intraoral ; prothèse implanto-portée ; scan body ; CFAO ; flux numérique

Abstract

Introduction: Digital impression technology has revolutionized implant prosthodontics by providing a more accurate and patient-friendly alternative to conventional methods. The objective of this report is to illustrate the clinical workflow and outcomes of a fully digital approach for the fabrication of implant-supported fixed restorations. **Clinical Observation:** A 45-year-old woman in a good general health presented with missing teeth 15 and 16 and requested fixed replacements. Following clinical and radiographic evaluation, two implants were placed. The prosthetic plan involved two screw-retained full-zirconia crowns fabricated entirely through a digital workflow. Intraoral scanning of scan bodies, CAD/CAM design, and milling were performed without conventional impression materials. **Discussion:** The digital workflow simplified both chairside and laboratory procedures, reducing time and improving efficiency compared with conventional methods. Digital impressions provided reliable and reproducible results for short-span implant-supported restorations. However, accuracy can be influenced by the scanning system, scan body design, and operator experience. **Conclusion:** Digital impressions enable precise and esthetic implant-supported restorations while providing comfort and efficiency. However, they still have limitations, particularly for full-arch restorations, and remain operator-dependent.

Mots clés : intraoral scanner; implant-supported prosthesis; scan body; CAD/CAM; digital workflow

INTRODUCTION

Over the past decade, digital impression technology has emerged as a transformative tool in prosthodontics, particularly in the field of implant-supported fixed restorations. With the advent of intraoral scanners and fully digital workflows, clinicians are increasingly able to bypass conventional impression materials, stone casts and plaster models. These digital methodologies allow direct capture of implant scan bodies, integration with CAD/CAM design software and efficient milling of definitive restorations. A growing body of evidence indicates that for crowns and short fixed dental prostheses, digital impressions yield accuracy and fit that are comparable to, and in some instances superior to, conventional techniques 1,2. In implant prosthodontics, digital workflows offer particular advantages 3,4. Moreover, the accuracy of the digital implant impression depends significantly on the intraoral scanner system, the design and fit of scan bodies, the operator's scanning strategy, and software algorithms 5,6. Given these developments and constraints, this case report presents the clinical protocol and esthetic outcome of a fully digital workflow for implant-supported screw-retained zirconia fixed prosthesis, illustrating the practical application, benefits and current limitations of digital impression techniques in implant prosthodontics.

CLINICAL OBSERVATION

A 45-year-old woman in a good general health presented with the absence of teeth 15 and 16.
She reported dissatisfaction with the edentulous space and requested fixed replacements to restore masticatory function and esthetics. Clinical examination (Fig. 1) revealed adequate bone volume and soft tissue quality, with no signs of active infection or periodontal disease.

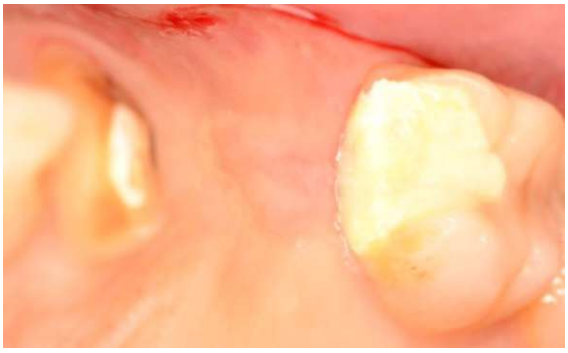

Figure 1 Preoperative situation

Radiographic evaluation, including CBCT, confirmed sufficient bone height and width for implant placement. After discussion of treatment options, a fully digital workflow for implant-supported screw-retained zirconia crowns was planned. Two implants were selected to replace teeth 15 and 16, to achieve an optimal prosthetic emergence profile, an occlusal integration, and an esthetic harmony.

Guided Surgical Phase:

A computer-assisted, fully guided surgical approach was used to ensure precise implant positioning according to the prosthetic plan (Fig. 2). The surgical guide was fabricated using CAD/CAM technology, based on the virtual planning integrating CBCT and digital impressions.
Implants were placed according to the guide, achieving correct angulation, depth, and spacing for future prosthetic restoration.

Figure 2 Guided surgical approach

After a standard osseointegration period of 3 months, two standard gingival healing abutments were placed to shape the peri-implant soft tissues and facilitate optimal emergence profiles for the definitive restoration (Fig. 3).

Figure 3 Healing phase with and without the gingival abutments

Digital Impression:

Once soft-tissue maturation around the implants was achieved, a complete digital impression protocol was performed using an intraoral scanner (Medit i600, Medit Corp., Seoul, South Korea).
The scanning sequence followed a standardized

approach to ensure optimal accuracy.

First, a preliminary scan of the maxillary arch without the scan bodies was carried out to record the peri-implant soft-tissue contours and emergence profile. This initial scan facilitates precise superimposition during CAD alignment and supports accurate design of the transmucosal portion of the restoration.

Next, the scan bodies were connected to the implants, and a second maxillary scan was taken to capture their exact 3D position and angulation (Fig. 4).

Figure 4 Intraoral view of scan bodies in place

Then, the antagonist arch was scanned, and an interarch bite registration was performed to accurately record the occlusal relationship and ensure correct articulation during CAD design.

Figure 5 illustrates the complete set of acquired digital scans.

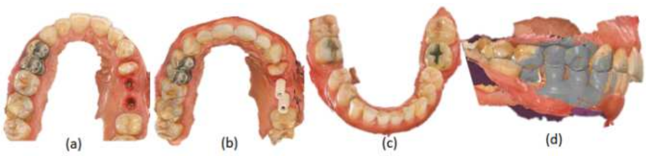

Figure 5 Overview of the digital scanning steps a. without scan bodies, b. with scan bodies, c. antagonist arch, d. occlusion

All datasets were automatically aligned and transferred to the CAD software, where the definitive screw-retained zirconia crowns were virtually designed then milled (Fig.6).

Figure 6 Final screw-retained full zirconia

This structured sequence of scans—soft tissues, scan bodies, antagonist arch, and occlusion—generated a precise digital model for prosthetic planning.

The restorations were tried in and adjusted for proximal contacts and occlusion before final torque. The final outcome (Fig. 7) demonstrated a passive fit, a harmonious occlusal integration, and satisfactory esthetics, with well-supported peri-implant soft tissues.

Figure 7 Intraoral view of the final result

DISCUSSION

Digital impression technology has transformed prosthetic implant dentistry, offering a predictable and minimally invasive workflow that reduces patient discomfort and improves clinical efficiency. Numerous studies have demonstrated that intraoral scanners (IOS) provide high accuracy for single-unit and short-span implant prostheses, making them a reliable alternative to conventional impressions in most clinical situations 1–4. In the present case, the digital protocol allowed precise capture of implant positions, efficient CAD/CAM design, and the fabrication of screw-retained zirconia crowns with an excellent fit and an esthetic outcome.

One of the main advantages of digital impressions is their ability to streamline the clinical workflow. Compared with conventional impressions—which require trays, impression materials, disinfection, and stone model fabrication—digital scans offer immediate visualization, error detection, and the possibility to rescan specific areas without restarting the entire procedure 2,5. Patient comfort is also significantly enhanced, especially in patients with gag reflex, limited mouth opening, or anatomical constraints. In addition, the digital workflow reduces laboratory steps, minimizes material distortion, and accelerates communication between clinician and technician 6,7.

From an accuracy standpoint, digital impressions for single implants have shown equal or superior precision compared with conventional methods 3,4,8. In this case report, the digital workflow provided a passive fit of the screw-retained crowns without the need for intraoral adjustments, highlighting the reliability of the technique for posterior short-span implant restorations.

However, several limitations must be acknowledged. The accuracy of digital impressions is influenced by multiple variables, including the scanner type, the scanning strategy, the implant angulation, the operator technique, and especially the design of the scan body 9–11. Scan body geometry—such as height, diameter, surface reflectivity, and geometric complexity—plays a critical role in the quality of the scan. Studies have shown that overly tall or complex scan bodies may introduce scanning errors, whereas simplified and rigid geometries enhance precision 10–12. Operators must also ensure that scan bodies are properly seated, free of debris, and adequately captured from multiple angles to avoid stitching errors during software reconstruction.

Another important limitation of digital impressions lies in full-arch implant cases, where accuracy significantly decreases compared with short-span scans. The larger the scanning area, the higher the cumulative stitching errors, leading to linear and angular deviations that may compromise the fit of the prosthesis 4,13. For this reason, full-arch or long-span implant rehabilitations may still require verification jigs, photogrammetry, or conventional impression techniques to ensure passive fit.

Technological evolution is expected to mitigate some of these limitations. Recent studies suggest that artificial intelligence (AI) workflows can improve point-cloud processing, correct mesh defects, and enhance stitching algorithms, potentially increasing accuracy in full-arch digital impressions 14. Similarly, ongoing developments in scan body engineering—such as hybrid materials, anti-reflective coatings, and geometry optimization—aim to standardize implant scanning across systems and reduce operator-dependent variability 11,12.

Despite these limitations, the fully digital approach used in this case proved to be efficient, predictable, and highly satisfactory for both clinician and patient. When applied in appropriate clinical situations, digital impressions represent a robust and reproducible option for implant-supported fixed prostheses. Continued technological refinement and additional clinical evidence will further expand their applications, particularly for long-span and full-arch rehabilitations where ultimate precision remains essential.

CONCLUSION

Digital impressions offer a precise, efficient, and patient-friendly approach for implant-supported restorations. By streamlining clinical and laboratory workflows, they enhance prosthetic fit, occlusion, and esthetics. Ongoing technological advances promise to further improve accuracy and expand their applications, making digital workflows a cornerstone of modern implant prosthodontics.

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