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CASE REPORT

Digital Workflow in Implant-Supported Fixed Partial Denture-A Case Report

Leoney Antony [a], Subhicsha S[b]

ABSTRACT

Managing patients with advanced periodontitis and high esthetic demands presents significant challenges. This case report describes a 58-year-old female with discolored mandibular anterior teeth due to gastric acid-induced erosion and maxillary anterior teeth with compromised periodontal and esthetic derangement. A comprehensive, digitally assisted treatment plan was implemented, integrating extraoral scans and CBCT. Virtual planning with EXOCAD, followed by implant placement, was done in the maxillary arch. Temporary restoration was given during the healing phase, and zirconia FPD on custom angulated abutments was delivered after five months. Mandibular teeth were stabilized with root canal /periodontal therapy and restored with a zirconia fixed partial denture (FPD) after digital planning using EXOCAD. The partially digital workflow ensured precise planning, optimal outcomes, and high patient satisfaction, highlighting the benefits of combining digital and conventional techniques for complex restorative cases.

Key words: digital workflow, implant, angulated abutments, zirconia FPD

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INTRODUCTION

In recent years, dentistry has witnessed a shift from traditional manual techniques to advanced digital workflows. Implant-supported restorations demand high levels of accuracy to ensure functional stability, esthetic excellence and long-term success. Traditional workflows often involve multiple steps prone to errors, inefficiencies and patient discomfort.

In contrast, digital workflow involves leveraging tools like CBCT scans [1], virtual planning and computer-aided prosthetic design, which allow clinicians and dental labs to achieve predictable results with minimal intervention for adjustments.

Integrating data from facial scans, CBCT [1,2], and extraoral scanners allows for the creation of prosthetic designs that seamlessly align with the patient's esthetic requirements while remaining within surgical constraints. This comprehensive approach ensures that the external profile of the patient is harmoniously addressed, enhancing both functionality and appearance. The advancements in combined surgical and prosthetic planning not only improves treatment outcomes but also offer significant benefits for patients and clinicians. This article highlights how integrating traditional methods with other digital tools simplifies implant planning and streamlines prosthetic workflow thereby enhancing clinical outcomes.

[a] Professor, Dept. of Prosthodontics and Crown and Bridge, Government dental college -Cuddalore district ,Chidamabram
[b] Intern, Dept. of Prosthodontics and Crown and Bridge, Government dental college -Cuddalore district ,Chidamabram

By addressing challenges such as angulated placements, complex multi-unit restorations, and esthetic compromises, partial digitalization sets a new standard for precision and efficiency in implant dentistry.

Case history

A 58-year-old female teaching professional presented to the clinic with concerns about the appearance of her discolored mandibular anterior teeth and mobility of her maxillary anterior teeth. Being in a profession that required regular interaction, she expressed high esthetic demands, seeking a solution that would restore her smile and confidence. Her medical history revealed a history of gastric ulcer and frequent regurgitation episodes, which were likely contributing factors to her dental condition.

On intraoral examination, the mandibular anterior teeth exhibited significant erosion, consistent with gastric acid exposure, while the maxillary anterior teeth showed advanced periodontitis (**Fig.1**). The central incisor (11) was missing, further compromising the esthetic and functional integrity of her dentition. Additionally, existing fixed partial dentures (FPDs) were noted in the regions of 14–16, 24–28,33-37 and 44-48.

Figure 1: Preoperative image of the Patient

Radiographic examination and diagnosis

Traditional impressions were taken and digitized using an extraoral scanner to create a digital file for precise evaluation and planning. Radiographic data were obtained through cone beam computed tomography (CBCT) (Vatech Pax-I Plus imaging system) (**Fig.2**), which provided detailed insights into the patient's dental and periodontal condition.

The CBCT analysis revealed the presence of periapical lesions in teeth 12, 21, 31 and 41 further complicating the clinical presentation. The periodontal status of maxillary and mandibular anterior teeth was found to be severely compromised as evidenced from bone loss.

Figure 2: CBCT image

Patient was diagnosed with generalized chronic periodontitis with periapical lesions, erosion and partial anterior edentulism. She was explained about the poor prognosis. However, she was unwilling for a removable prosthesis but was willing for a fixed prosthetic treatment option.

The clinical findings highlighted the need for a multidisciplinary and patient-centered approach to address her functional and esthetic demands. A comprehensive treatment plan was devised, integrating conventional and digital technologies to achieve precise diagnostics, treatment planning, and execution.

Treatment procedures

Implant supported FPD in Maxillary anterior teeth

Digital planning with the existing CBCT images and lab scanned casts was done by means of EXOCAD software (Exocad Gmbh, Darmstadt, Germany) [3] and virtual implants were planned in the region of 13 & 21.A surgical guide was prepared for the implants to be placed i.e. Noris implants (Noris Medical, Nesher, Israel). During the surgical procedure, the bone quality in 13 region was found to be highly porous, so implant was placed instead in 12 region (3.75 mm diameter, length 11.5 mm, Noris Tuff implant). In 21 region 3.75 mm, length 13 mm, Noris tuff implant was placed. The decision was made to give cantilever

pontic in 13 region. As anticipated the implant had to be placed in a steep angle of 30°-45 with the horizontal plane.

Prosthetic phase of Implant treatment

Temporization

The patient required a fixed temporary restoration as she was in the teaching profession**.** The patient was given a semi fixed temporary prosthesis with the fixed portion utilizing 22 /23 as abutments and the non-fixed portion (clasp retained) utilizing 14 as abutment (**Fig.3**).

Figure 3: Temporary restoration after implant placement

Definitive Implant supported prosthesis

After 5 months of healing, cover screws were uncovered for stage 2 surgery and prosthetic rehabilitation. Healing abutments of 6 mm length, diameter 3.8 mm were used to create an adequate emergence profile in relation to the 2 implants (**Fig.4**).

Figure 4: Gingival cuff formed after removal of healing abutment

Implant abutments were tried to determine whether any angulated abutments would be required (**Fig.5**). Impression procedures were done using closed tray impression technique using silicone impression material (Zhermack, Badia Polesine, Italy). In the laboratory phase, implant analogues were placed on the impression and casts were poured. To get appropriate emergence profile, silicone soft cast material was poured around the implant. It was decided to use angulated abutments of 25 degree for both implants to achieve adequate esthetics. The prosthesis was designed in the laboratory using EXOCAD software[3,4,5] (**Fig.6**). The definite prosthesis was cement retained Zirconia FPD with 21/12 implants as abutments and 11/ 13 as pontics (**Fig.7**). The prosthesis was milled by DG shape-DWX52 D, Japan.

Figure 5: Trial Implant abutment

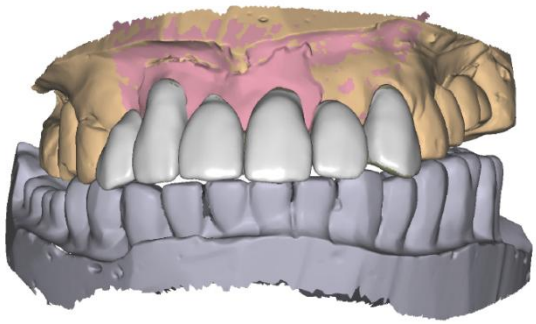

Figure 6: Maxillary Anterior Implant supported FPD designed by EXOCAD

Figure 7: Cementation of Maxillary implant supported FPD

Digitally fabricated crowns for Mandibular anterior teeth

Intentional RCT was done in 31&41. Teeth preparations were done in relation to 32,31,41,42,43(**Fig.8**). Impressions were made using silicone impression material (Zhermack, Badia Polesine, Italy). Impressions were poured in die stone and the cast obtained was scanned by Lab scanner ((3D pro H, China). Digital planning was done using Exocad to ensure precise margin placement, optimal clearance (appropriate overjet and overbite) [4,5] and protection of gingival architecture (**Fig.9**). This was done to guard the periodontally compromised mandibular anterior teeth. Zirconia FPD was given in relation to 32,32,41,42 and 43. In relation to retainers 42 and 43, pink ceramic was added to match the gingival colour.

Figure 8: Mandibular anterior teeth preparation for crowns

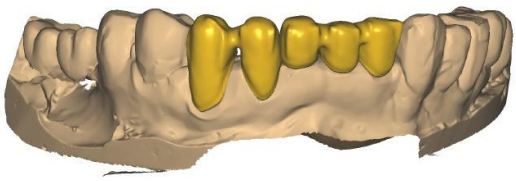

Figure 9: Mandibular Anterior crowns designed by EXOCAD

Figure 10: cemented final prosthesis in mandibular anterior teeth

DISCUSSION

This case highlights how a partially digital workflow facilitates accurate diagnosis, treatment planning and execution leading to a successful functional and esthetic outcome. Mahato et al[6] have demonstrated that digital workflows reduce errors, minimize working time, improve predictability of treatment outcome and enhance patient comfort and satisfaction. In this patient digital planning helped to identify the need for angulated implant placement allowing the clinician to modify the surgical plan accordingly. Another important aspect was management of periodontally compromised teeth. The patient's unwillingness for extraction modified the treatment plan in a way that emphasized on stabilizing the mandibular anterior with root canal therapy and layered zirconia fixed partial denture.

Aldowish et al[7] suggest that with proper analysis during treatment planning, preserving natural teeth alongside implant supported restorations can offer long term functional stability. Digitalization also benefitted the prosthetic phase. By using angulated abutment for implant in 21 and 12, functional and esthetic challenges were solved without requiring excessive bone augmentation procedure. Further angulating the abutment utilizing multiunit abutments were not undertaken as it might interfere in the palatal gingival tissues. Hence, it was decided to utilize the cement retained implant supported FPD in contrary to the Screw retained implant supported FPD previously planned via EXOCAD software.

This case emphasizes the importance of a hybrid approach to optimize patient outcomes. Digital workflow is a reality that can be incorporated into routine dental practice for better outcomes, however the learning curve for software utilization, investment for equipments can present challenges. In addition, clinical adaptability remains essential to manage intraoperative findings such a poor bone quality found during implant surgery in this case.

CONCLUSIONS

The mandibular FPD stabilized periodontal health and improved esthetics, while the implant supported maxillary FPD restored function and appearance. The partially digitalized workflow enabled precise planning, reduced complications

and met the patient's high esthetic expectations. This case highlights the effectiveness of integrating digital tools with conventional techniques in complex restorative cases. Usage of CBCT and EXOCAD software has enabled enhanced precision in not only implant placement but also fabrication of functionally and esthetically optimal prosthesis.

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Corresponding Author Details: Dr.Leoney.A MDS,PhD, Professor, Government dental college and Hospital, Cuddalore district, Chidambram.
Email: antony.leoney@gmail.com Ph No: +91 9790580225

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