The 21st European Consensus Conference (EuCC) of the BDIZ EDI updates practical guide to the digital workflow

Digital implantology in transition

The digital workflow in dentistry has undergone a significant technological leap over the past two years. Oral implantology in particular has been strongly affected by this development. AI-supported analysis methods, interconnected data platforms, and highly precise CAD/CAM processes now define a workflow that is faster, safer, and more predictable than ever before. This is the conclusion of the 21st Expert Symposium of the BDIZ EDI and, at the same time, of the European Consensus Conference (EuCC), which has updated the BDIZ EDI practical guide originally published in 2024.

At the same time, the speakers and the internationally composed EuCC panel emphasise that one fundamental principle remains unchanged: clinical responsibility continues to rest entirely with the practitioner—even as AI systems become increasingly powerful.

Modern software identifies anatomical structures more reliably, merges imaging data more precisely, and supports implant positioning with a high degree of predictability. Open interfaces and cloud-based platforms enable a seamless, fully integrated workflow between dental practice, laboratory, and industry.

New CAD/CAM systems provide surgical guides, temporary restorations, and suprastructures with improved accuracy of fit and shorter production times. Guided surgery and digital prosthetics are now standard components of modern implant treatment.

Despite all technological advances, one point remains indisputable: AI is an assistance system, not a decision-maker. Final clinical assessment, indication setting, surgical execution, and therapeutic responsibility continue to lie entirely with the practitioner. AI-supported tools provide valuable assistance, but they do not replace professional expertise or the clinician's duty of care.

Conclusion

Over the past two years, digital implantology has reached a level of maturity that sustainably improves precision, efficiency, and the patient experience. At the same time, the practitioner's role remains central: modern technologies expand possibilities, but they do not replace human clinical responsibility, experience, and decision-making ability.

Availability

The practical guide 2026: The digital workflow in oral implantology will be sent free of charge to all members. It can also be purchased in German and English from the BDIZ EDI online shop at BDIZ EDI for EUR6.00 plus shipping costs.

European Association of Dental Implantologists
Bundesverband der implantologisch tätigen Zahnärzte in Europa e.V.

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2nd Update: The digital workflow in oral implantology

21st European Consensus Conference (EuCC) in Cologne in 2026 — 14 February 2026

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Preamble

Due to the rapid advances in digital workflows, particularly in the field of CAD/CAM-supported superstructures, the EuCC Guideline—last updated in 2024—has again been updated in 2026.

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1 Methodology

1.1 Objective
This guideline offers recommendations to help clinicians correctly assess potential indications for a digital workflow in implant dentistry and its limitations.

1.2 Introduction
This guideline covers the various digital procedures for diagnosis, surgical preparation, digital implant planning and prosthetic rehabilitation typically used in accordance with the indications recommended by the European Consensus Conference on implantology (EuCC), Cologne (Germany) on 14 February 2026.
All consensus recommendations in this paper should be considered as indicative only. The patient's individual situation must be considered, as it dictates all subsequent procedures and may justify deviations from the pronouncements made in this guideline.

1.3 Background
Digital procedures to improve or simplify the implant prosthetic workflow are presented for various treatment steps. To ensure an acceptable treatment outcome, the selection of the appropriate digital procedure for each indication is necessary.

1.4 Literature search
The Cochrane Library, EMBASE, DIMDI and Medline literature databases were used to conduct a systematic search of recent published data on digital workflows and directly related topics. Selective search criteria were used, including terms such as *digital, implant, cad/cam, grafting, guided surgery, abutment, superstructure, surgical guide, printing, AI.* The publications identified by the search were screened by reading their abstracts; and those irrelevant to the subject were excluded. Articles found to be potentially relevant were obtained in full-text form. Multiple review papers with meta-analyses and randomised controlled trials (RCTs) as well as other prospective or retrospective systematic clinical studies proved to be available on the subject.

1.5 Procedure for developing the Consensus Conference guidelines
The 2024 update of the EuCC Guideline served as the basis for the EuCC deliberations. This was reviewed and discussed by the members of the EuCC after updating (in particular) Section 7 "Digital lab procedures". The preliminary report was then reviewed and discussed by the sitting committee members in five steps as follows:

- Reviewing the preliminary draft
- Collecting alternative proposals
- Voting on recommendations and levels of recommendation
- Discussing non-consensual issues
- Final voting

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2 Problem

Complex implant/prosthetic treatment can be performed in various stages with the support of digital technology. Today the aim in selected cases has been to improve the treatment efficiency and outcome by using a fully digital workflow **[34, 35]**. Various concepts are in use, but the innovation cycles and outcomes should be considered for complication-free use in daily practice.

3 Digital diagnosis

3.1 Introduction

Routine implantological diagnosis continue to rely primarily on referenced panoramic radiographs (panoramic images with calibration markers). However, these imaging modalities are associated with inherent limitations regarding measurement accuracy and the reliable assessment of available bone volume **[26, 81]**. Morphological studies clearly demonstrate that 3D diagnosis enables precise evaluation of the osseous site in all regions of the jaws. Moreover, 3D imaging constitutes an essential prerequisite for the implementation of the prosthetic treatment objective using guided (navigated) surgical procedures **[61, 62]**.

3.2 Cone beam computed tomography (CBCT)

The use of three-dimensional data based on cone beam computed tomography (CBCT) provides more comprehensive diagnostic information and thereby helps to avoid problems and complications while enabling a more detailed and reliable diagnosis **[21]**. In addition to the classical indications, such as the assessment of grafting procedures or the evaluation of individual jaw morphology, contemporary clinical indications now also include immediate implant placement, immediate loading protocols and techniques aimed at the precise implementation of the prosthetic treatment objective **[63]**. Contemporary CBCT systems employing low-dose protocols allow for accurate implant planning with reduced radiation exposure, without compromising the precision of guided implant placement **[71]**.

4 Digital impression and imaging

Digital information other than X-ray can contribute to the overall prosthetic diagnosis based on function and aesthetics.

4.1 Definition

Digital impressions obtained via chairside scanning constitute the data basis for the fabrication of surgical guides, master models, implant abutments and gingiva formers.

4.2 Current observations

Digital impressions and CAD/CAM procedures save time and provide stable and predictable outcomes **[103]**. There is no difference in terms of clinical outcomes between conventional and digital impressions, even in full-arch cases **[25, 50]**. The accuracy of full-arch scanning by IOS differs based on clinical scenarios such as scanning strategies **[49, 99]**.
Digital scanning has been shown to be time-efficient and straightforward for implant-supported restorations, for example due to the use of scanbodies **[52]**. No significant differences in radiographically measured marginal bone loss were observed between treatments based on digital scans and those using conventional impressions **[79]**.
Emerging technologies such as spectrophotogrammetry may substantially improve workflows in fully edentulous patients or in patients with multiple implants **[73]**.

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The best-fit algorithm registration method demonstrated higher trueness and precision in dentate jaw regions compared with manual point-to-point registration. The accuracy of the registration between digitised occlusal surface scans and digital casts is influenced both by the registration method used and by the location and extent of edentulous areas **[66]**.

4.3 Prevention of complications

- Accurate scanning of a complete dental arch requires specific scanning strategies.
- However, the digital transfer of occlusal relationships and articulation has not yet been fully established for routine clinical use.
- Significant differences in accuracy have been identified among intra-oral scanners, making an individual, indication-specific selection necessary for different treatment protocols **[99]**.

5 CAD/CAM-supported grafting techniques

5.1 Introduction

To reduce donor-site morbidity, various types of allogeneic or xenogeneic block grafts have been introduced in the past **[46]**. The reported outcomes and the available evidence remain controversial **[7, 10]**. Alternatively, titanium meshes have been used to stabilise grafts; however, this approach requires extensive intraoperative adaptation to the defect morphology. Individually manufactured implants produced by copy-milling and segmented CBCT data were presented in the past but have not become established for routine clinical use **[42, 78, 86]**.

5.2 Custom-made bone blocks and implants

To improve outcomes and simplify clinical workflows, the use of CAD/CAM technology in combination with CBCT data for the individualised fabrication of bone blocks, titanium meshes and implants is recommended **[12, 13, 47, 88]**.
To further enhance clinical results, various techniques involving three-dimensional printed frameworks, including the optional use of stem cells or bone morphogenetic proteins (BMPs), are currently under scientific investigation **[12]**.

5.3 Current observations

Reports on corresponding clinical outcomes remain controversial **[24, 41]**.
Exposure rates of CAD/CAM-fabricated titanium meshes are lower than those reported for conventionally shaped meshes; however, exposure rates as high as 31% have still been observed **[30, 106]**.

5.4 Prevention of complications

All techniques described require specific and meticulous soft-tissue management.

6 3D-based guided implant placement

6.1 Introduction

Various systems for guided surgery are available, using either surgical guides or real-time navigation **[20, 58]**. The accuracy of static surgical guides does not differ significantly from that of dynamically guided surgery **[3, 53, 103]**. Studies on guided implant surgery demonstrate that, under clinical conditions and when protocols are strictly followed, a positional deviation of approximately 1 mm and an angular deviation of about 5 degrees from the planned ideal implant position can be expected. In contrast, the outcomes of freehand implant insertion cannot be reliably predicted **[37, 59, 60, 94]**. Minimum distances to neighbouring structures (e.g. inferior alveolar nerve, adjacent teeth, maxillary sinus) must be maintained.

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6.2 Support of surgical guides

The support and intraoperative positioning of surgical guides can be achieved in different ways. In addition to tooth-supported or mucosa-supported guides, bone-supported guides as well as stabilisation using auxiliary implants or anchor pins have been described. Clinical outcomes are reported to be similarly favourable across these support modalities **[20, 60, 91]**.

6.3 Optimisation of the prosthetic treatment objective

Matching and registering digital prosthetic planning data (e.g. wax-ups or mock-ups) or three-dimensional photographic data is indicated and, through a 3D-based workflow combined with 3D printing, results in surgical guides that precisely incorporate the intended prosthetic treatment objective.

6.4 Support for minimally invasive procedures

Based on digitally acquired and optimised planning data, in combination with the implementation accuracy of guided surgery, soft-tissue mobilisation for augmentation or implant placement can be reduced in many cases. Examples include modified approaches to external sinus floor elevation or bone-splitting techniques, in which the soft tissues covering the residual bone can be preserved **[64, 65]**.
Emerging technologies using augmented reality-assisted navigation may offer greater accuracy than conventional navigation systems and freehand procedures **[101, 102]**.

7 Digital lab procedures

7.1 3D printing

7.1.1 Introduction

Various printing techniques are available for the fabrication of surgical implant guides, 3D-based metallic primary frameworks, healing abutments and secondary ceramic or polymer superstructures **[69]**.

7.2 CAD/CAM-supported abutments and superstructures

7.2.1 Definition

Several CAD/CAM manufacturing techniques are available, including milling, three-dimensional printing, and selective laser melting (SLM) **[38, 43]**. All of these techniques require a validated workflow **[90]**.
Investigations into the accuracy of screw-retained CAD/CAM abutments have demonstrated higher accuracy compared with conventionally manufactured or copy-milled superstructures, with no relevant differences observed between the materials used **[1, 22, 23, 39]**.
Accordingly, the marginal fit of interim crowns and implant-supported frameworks manufactured using either additive or subtractive techniques is within the clinically acceptable range **[22, 56, 95]**. Nevertheless, a study using micro-computed tomography demonstrated that crowns produced with different 3D printers showed considerable differences in fit **[11, 27]**.
A newly formulated 3D printing resin, however, exhibited lower volumetric shrinkage, high accuracy, and sufficient mechanical properties compared with commercially available resin materials **[45]**.
It was also shown that the type of surface treatment influences surface roughness, translucency, and colour in all CAD/CAM manufacturing techniques **[8, 14, 62, 84, 85, 100]**.
Evidence regarding the mechanical properties of three-dimensionally printed and computer-aided design/computer-aided manufacturing (CAD/CAM) materials remains limited **[107]**. An *in vitro* study demonstrated that the manufacturing method can influence mechanical properties. 3D-printed materials

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showed inferior mechanical properties compared with milled materials, although thermocycling negatively affected all materials tested **[75]**. Conversely, it has also been demonstrated that 3D-printed resin crown materials caused less antagonistic enamel wear than lithium disilicate **[17]**.
There is evidence suggesting that resin composite blocks may reduce biofilm formation **[36]**.
More recently, progress in metal-based 3D printing has also been reported; however, these developments do not yet have clinical relevance **[82]**.

7.2.2 Current observations

The available data suggest promising results for CAD/CAM-fabricated implant-supported restorations. A six-month follow-up study of implant-supported monolithic rehabilitations using fixed prostheses according to the All-on-4 concept and a fully digital workflow demonstrated that this approach already represents a viable treatment option **[19, 68]**. However, the current level of evidence remains limited due to the quality of the available studies and the lack of long-term clinical data (five years or more) **[32, 69]**.

7.2.3 Prevention of complications

- When using CAD/CAM techniques, it is recommended to adhere to a validated workflow.
- If any step within the workflow is modified, revalidation of the entire workflow is advisable.
- Due to the flexibility of the mandible, non-precious metal frameworks should be used for full-arch reconstructions. For ceramic veneering, a highly elastic alloy is recommended.

8 AI in implant dentistry

8.1 Introduction

An increasing number of studies are applying deep learning techniques in oral implantology, particularly in digital radiological imaging **[6]**. AI models using panoramic and periapical radiographs can accurately identify and Classify dental implant systems or detect changes in marginal bone levels **[5, 18]**.
Segmentation of anatomical structures is further enhanced through AI-assisted approaches **[2]**.

8.2 Current observations

New algorithms are capable of identifying critical anatomical structures, such as the inferior alveolar nerve canal, as well as determining available bone for AI-supported implant planning **[6]**. However, an additional clinical benefit compared with conventional approaches has not yet been demonstrated **[54]**.

8.3 Avoiding complications

The oral surgeon ultimately bears clinical responsibility. All AI-supported processes require monitoring and, if necessary, correction.

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9 Summary

Digital technologies in implant dentistry are improving, with good clinical outcomes and improvements in patient-related outcome measures (PROMs). Specific parameters for individual workflows must be considered by the healthcare provider.

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Literature