Case Report

Simplifying the pathway to *chairside*

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- He lectures nationally and internationally and is the author of several books and articles.

The technology of computer-aided design and manufacturing (CAD/CAM) has been the long-standing promise for achieving same-day restorative dental care since its introduction. Yet for many years, chairside workflows remained out of reach for routine clinical use, and adoption was often hesitant. Early CAD systems were designed primarily for dental technicians and required specialized skills and confident use of complex software. While these tools were clinically effective, their complexity and time demands made it difficult to integrate into busy practice schedules. [1]

In the early stages of digital dentistry, scanning, design, and manufacturing often relied on separate, non-integrated systems (Fig. 1). Workflows required multiple handoffs - exporting files, converting formats, and re-importing data across different platforms and access points. [2] This fragmentation added complexity, slowed turnaround times, and eroded staff confidence in the process. In other words, the workflow was "digital," but it was not truly connected. The illustrations (Fig. 2) should therefore contrast an older fragmented digital workflow with a modern integrated one, highlighting the reduction of hand-offs and automated data transfer that defines today's connected ecosystem.

INTRODUCTION

Modern CAD ecosystems, such as the iTero™ Design Suite (Fig. 3), have transformed the chairside restorative environment. These platforms consolidate the full workflow - from intraoral scanning to design and fabrication within a single, unified ecosystem. [3]
Rather than operating as isolated tools, they function as connected applications that exchange data directly with scanners, milling units, and 3D printers, enabling an integrated digital workflow. [4]

FIG. 1 *Multi-step workflow typical of early CAD/CAM environments.*

FIG. 2 *Full digital workflow sequence from intraoral scanning to CAD design, production, and final staining and polishing.*

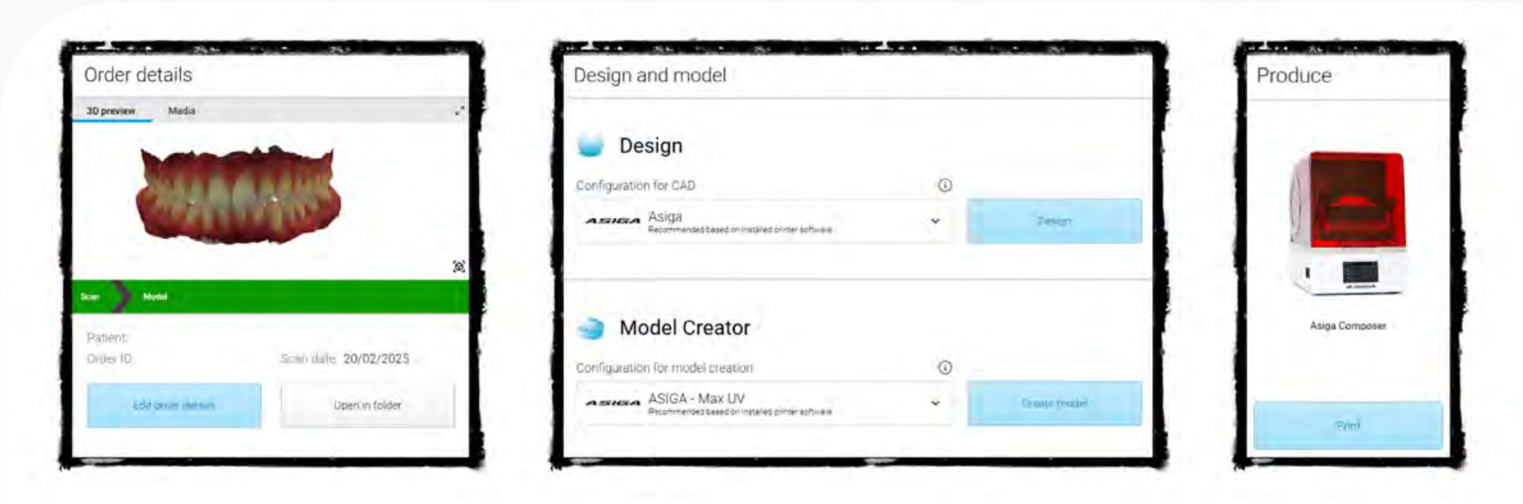

FIG. 3 *Integrated workflow from scan to design and production within a unified platform.*

As a result, clinicians can more reliably complete restorative procedures in a single visit by reducing friction and delays between workflow stages.

Recent advances in artificial intelligence (AI) have further accelerated this shift, adding both technical capability and a new level of usability to chairside systems. Digital systems reach their full potential when operational performance is paired with intuitive interfaces. Guided workflows and restorative libraries help clinicians without laboratory training adopt digital design tools more confidently. [5] AI-enabled features - such as automated margin detection, occlusal mapping, and tooth anatomy proposals reduce manual steps and shorten the learning curve. [6] These capabilities allow dentists to design and refine restorations in-office, decreasing reliance on external laboratory support.

FIG. 4, 5 *(4) Digital design of a crown restoration showing margin detection and final proposal in iTeroTM Design Suite CAD software.*
(5) QRcode: supplementary video demonstrating crown design in the iTero™ Design Suite CAD software using an AI-assisted initial design proposal, followed by manual refinement.

Based on my evaluation of an upcoming AI crown design feature integrated into the iTero™ Design Suite which automatically generates an initial design proposal (Fig. 4, 5 (QR)) - I found that it produced consistent, predictable outputs while significantly reducing design time. In my view, this type of automation can meaningfully lower adoption barriers for clinicians who are new to chairside workflows.

The integrated workflow also increases the overall value of existing equipment. Many clinics already have intraoral scanners and 3D printers, but they are often used as separate, loosely connected devices. When these tools share a common CAD platform, however, they function as a single system (Fig. 6). [7] By eliminating manual file exports and format conversions, the workflow helps reduce chances for data loss and supports accurate translation from the digital design to the manufactured restoration. [8]

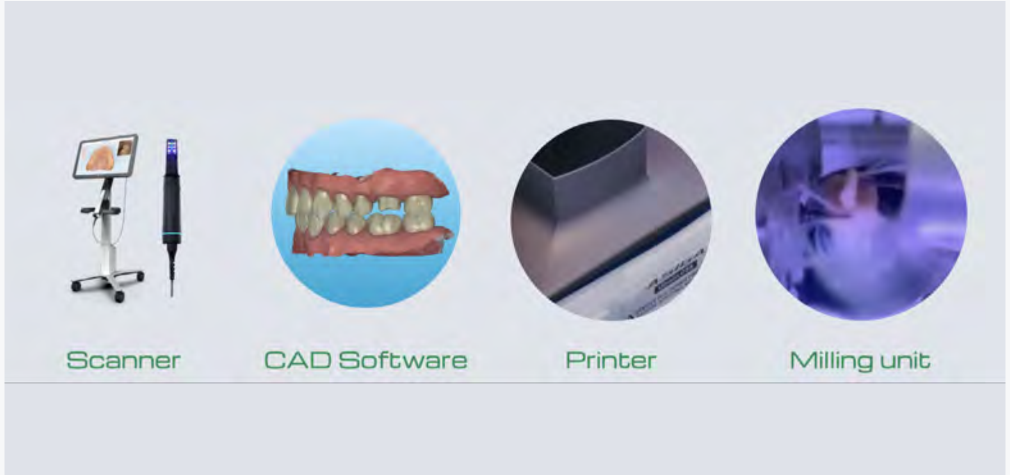

FIG. 6 *Workflow integration showing scanner, CAD design, 3D printing, and milling as connected processes within one digital system.*

FIG. 7 *A 3D-printed occlusal splint in situ.*

CLINICAL APPLICATIONS

The iTero™ Design Suite CAD software enables clinicians to select workflows based on clinical indication and material requirements, supporting a range of chairside applications including occlusal splints, esthetic mock-ups, provisional and definitive restorations, and minimally invasive overlays. [9] For clinicians adopting chairside fabrication, occlusal splints and provisional restorations can serve as practical entry points before progressing to more complex restorative indications. [10]

CASE 1 – OCCLUSAL SPLINT

The first case demonstrates chairside fabrication of an occlusal splint for a patient with parafunctional habits and morning muscle tension. Intraoral scans (Fig. 7) were captured with the iTero Lumina™ intraoral scanner in maximum intercuspation, and the splint was digitally articulated and designed (Fig. 8, 9). The connected workflow enabled same-day manufacturing and delivery, providing immediate symptom relief and improved functional comfort.

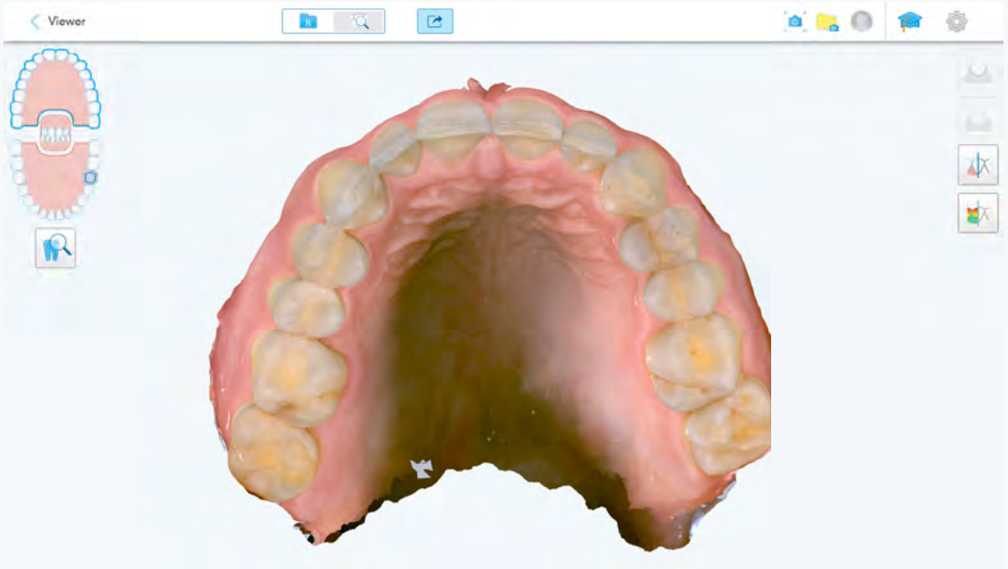

FIG. 8, 9 *(8) Accurate intraoral scan taken with the iTero™ Lumina intraoral scanner. (9) Supplementary video demonstrating the digital workflow for bite splint design in the iTero™ Design Suite CAD software.*

FIG. 10, 11 *Chairside provisional crown for retained primary tooth 6.3 during orthodontic treatment.*

CASE 2 - PROVISIONAL CROWN ON A RETAINED PRIMARY TOOTH

The second case involves an orthodontic patient with a retained primary maxillary lateral incisor (FDI 6.3) requiring a provisional esthetic solution during active treatment. Following conservative tooth preparation, the tooth was scanned, and a provisional crown was designed and fabricated chairside in the same visit (Fig. 10, 11). This approach improved esthetics while preserving soft-tissue architecture and maintaining flexibility for future implant planning.

"This orthodontic approach improved esthetics while preserving soft-tissue architecture and maintaining flexibility for future implant planning."

CASE 3 – ENDOCROWN FOR A MOLAR WITH EXTENSIVE CORONAL LOSS

A third clinical scenario involved a molar with extensive coronal loss requiring an endocrown restoration. After endodontic retreatment, the tooth was prepared under rubber dam isolation to ensure moisture control. Digital scanning under isolation enabled precise margin capture, after which the endocrown was designed, milled, and delivered in a single visit (Fig. 12-16).

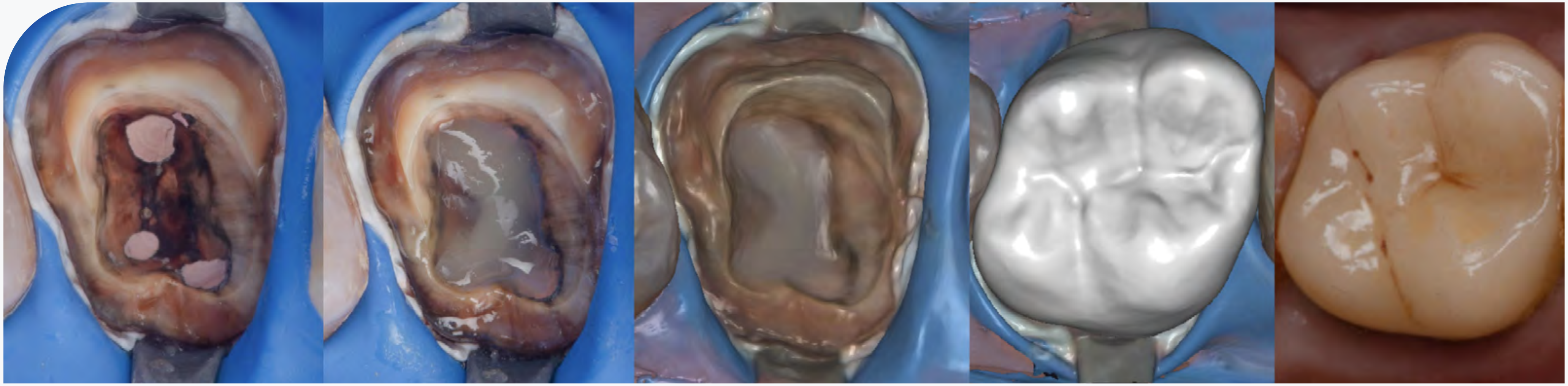

FIG. 12-16 *Sequence from preparation to final endocrown restoration of tooth 1.6. The scan was performed under rubber dam isolation showing margin clarity and moisture control.*

In my clinical experience, a single-unit restoration that previously required two visits and a 7-10 day laboratory turnaround can now be completed in approximately 60–90 minutes. This can improve patient convenience and satisfaction, reduce chair time spent on temporization and follow-up visits, and illustrates the practical value of a fully connected workflow.

Note on scanning under rubber dam isolation: Digital workflows provide an underappreciated benefit through intraoral scanning protocols which show better results between rubber dam and non-rubber dam impression scans. The process of scanning under rubber dam isolation improves both marginal definition and moisture control which results in better visualization of preparation boundaries and eliminates soft tissue interference. [11] Modern scanners can achieve both benefits through their real-time AI-based color rendering system and adaptive stitching technology which produces exact results for complex margins and subgingival areas while preserving accuracy. [12]

CASE 4 - DIGITALLY GUIDED ESTHETIC MOCK-UP

Finally, a patient seeking esthetic improvement of the upper anterior teeth underwent a digitally guided smile design. Facial reference lines were established and a virtual wax-up was created to evaluate shape and proportion.

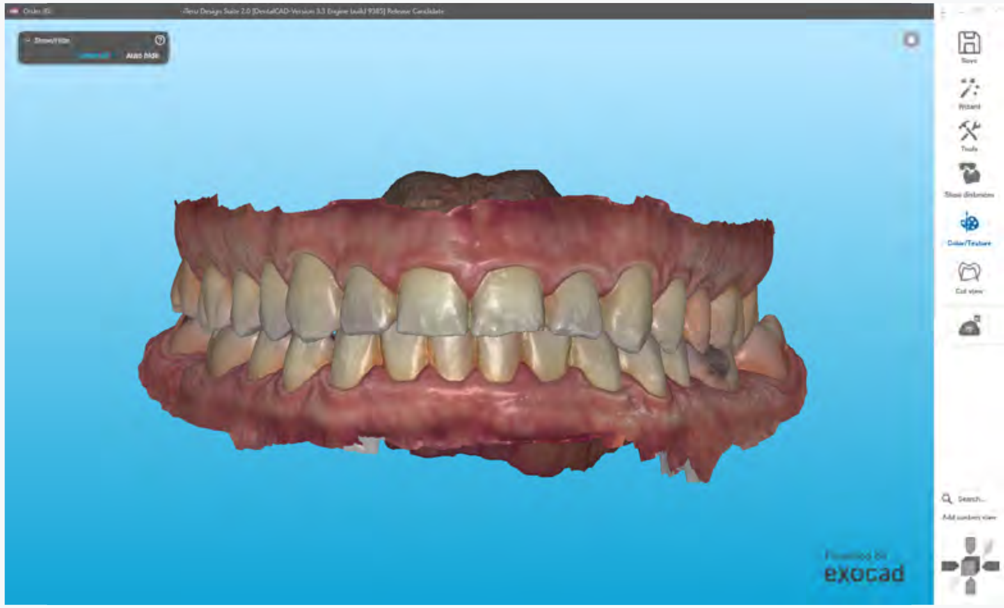

FIG. 17 *Chairside mock-ups provide a visual and physical preview of proposed esthetic changes prior to definitive treatment.*

"A chairside mock-up was then designed and fabricated, allowing the patient to visualize and functionally test the planned esthetic outcome prior to definitive treatment."

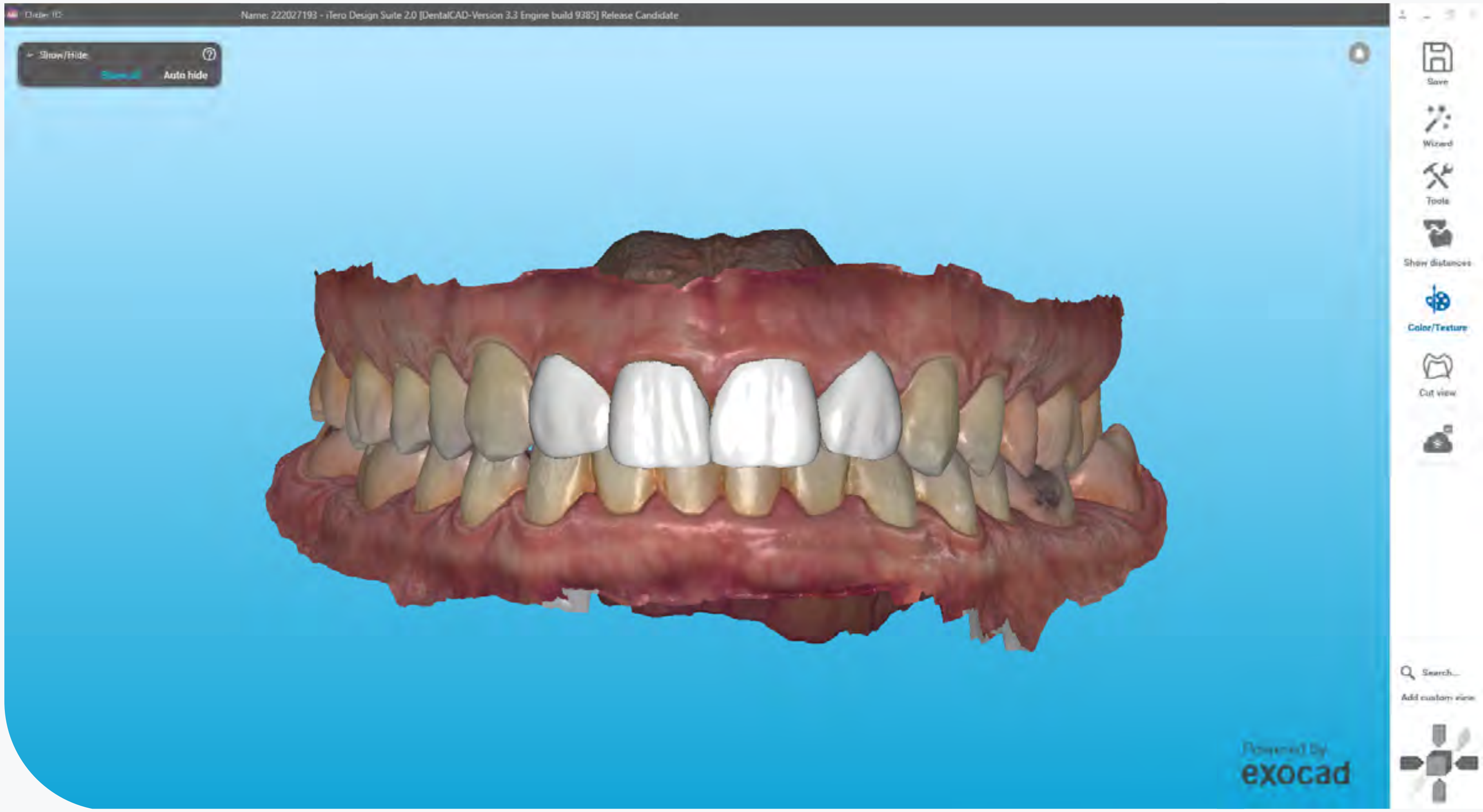

FIG. 18 *Chairside mock-ups provide a visual and physical preview of proposed esthetic changes prior to definitive treatment.*

A chairside mock-up was then designed (Fig. 17, 18) and fabricated, allowing the patient to visualize and functionally test the planned esthetic outcome prior to definitive treatment.

DISCUSSION

From a manufacturing perspective, 3D printing offers advantages in material efficiency, speed, and the ability to produce complex geometries, making it well suited for applications such as occlusal splints. In contrast, milling typically provides higher precision, mechanical strength, and immediate readiness for definitive restorative indications. When both manufacturing modalities are available (Fig. 19, 20) within the same connected workflow, clinicians can select the most appropriate approach for each indication, expanding clinical flexibility while maintaining efficiency and quality in chairside care.

Nevertheless, limitations remain. Chairside CAD/CAM workflows are generally most predictable for single-unit restorations, small bridges, occlusal appliances, and esthetic prototypes, whereas extensive rehabilitations and complex implant frameworks often still require laboratory support. [13] Material selection also requires careful consideration, as not all printable or millable resins are approved or appropriate for long-term definitive restorations. [14]

FIG. 19-22 *(19) Example of a milling unit. (20) Example of a 3D printer. (21-22) Printable and millable materials.*

Long-term success depends on understanding how available materials perform in terms of mechanical properties and optical characteristics, including wear resistance, translucency, and fluorescence.

Implementation challenges also persist in digital communication and connected workflows, most notably around interoperability and training requirements. [15] Although many platforms are described as "open," real-world interoperability between systems can remain limited due to proprietary formats, restricted integrations, or workflow constraints. [16] Successful integration therefore depends not only on technology, but also on ongoing education, standardized communication protocols, and strong collaboration with industry partners across scanning, design, manufacturing, and materials. In parallel, as cloud-based platforms (Fig.23) become increasingly central to clinical communication and data exchange, organizations must prioritize data protection and cybersecurity as foundational requirements rather than optional add-ons. [17]

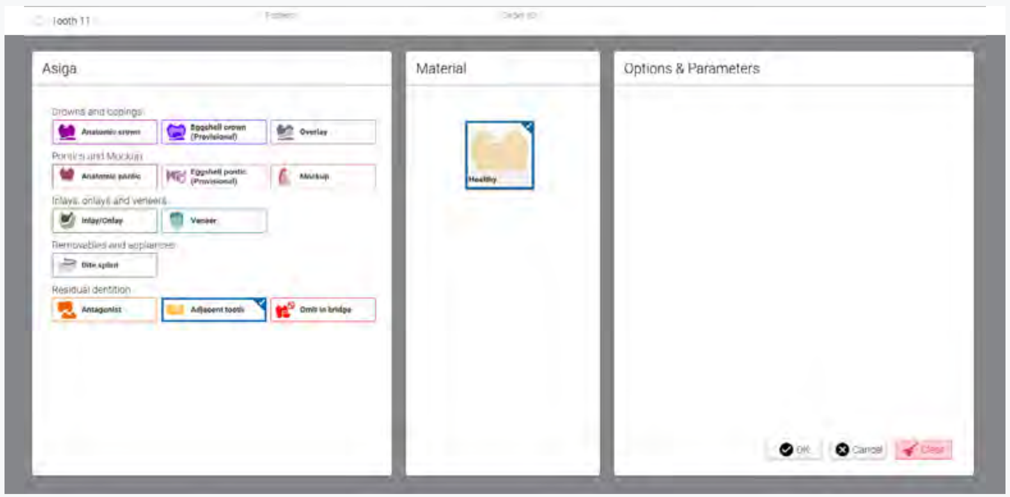

FIG. 23 *Workflow selection interface within the iTero™ Design Suite CAD software.*

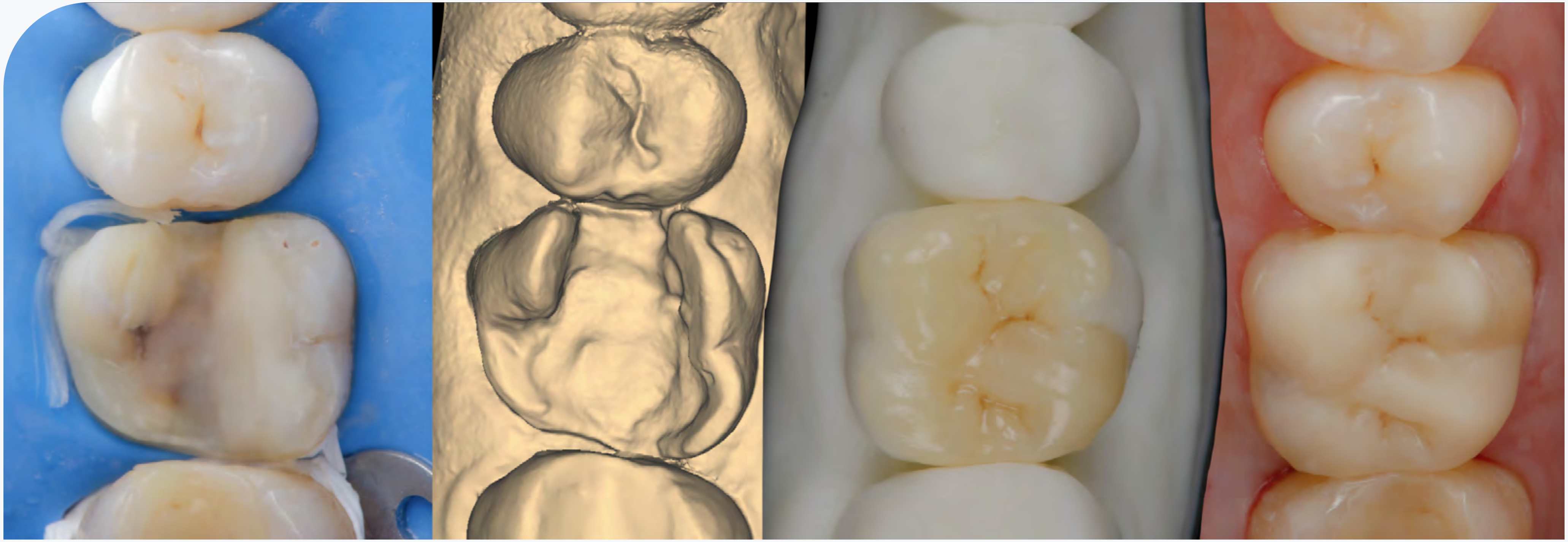

FIG. 18 *Chairside mock-ups provide a visual and physical preview of proposed esthetic changes prior to definitive treatment.*

CONCLUSIONS

Looking ahead, the direction is clear. The next phase of digital dentistry is likely to be shaped by three converging developments: artificial intelligence, real-time cloud collaboration, and hybrid manufacturing workflows that combine additive and subtractive techniques. [18] Together, these advances have the potential to accelerate restorative workflows, improve predictability, and support more sustainable use of materials while expanding the range of chairside indications.

Ultimately, for chairside dentistry to scale, technology must align with clinical objectives through true simplification and integration. When digital tools function as connected diagnostic and therapeutic extensions of the clinician - rather than as isolated devices - workflows become faster, more predictable, and easier to adopt with confidence (Fig 24-27). [19] The clinical applications described in this article - occlusal splints, esthetic mock-ups, and definitive restorations share the same underlying principle: when scanning, design, and manufacturing operate as one coherent system, chairside dentistry becomes more efficient, reliable, and clinically practical. [20]

SOURCES