

## Partner News

# Traditional optimised for *digital*: 3D Denture Guide and AcrySmartDigital

## INTRODUCTION TO DIGITAL DENTURES

In recent years, the spotlight in dental technology has intensively focused on digital dentures, marking a pivotal shift in how dental professionals and companies approach denture design. However, this journey hasn't been without its challenges. The evolution of denture design has seen a significant shift with the development of software.

Ruthinium has developed the 3D Denture Guide system, a solution born out of the necessity to tailor digital tools to the specific needs of denture design. A company with over half a century's worth of experience in producing acrylic teeth, it has not shied away from the digital

revolution. Instead, it has embraced the opportunity to aid dental teams in transitioning into the digital era without compromising on the quality of materials used.

This commitment to innovation led to the development of the Denture Guide system and AcrySmart Digital, a line of acrylic teeth optimised for digital workflows together with Antonello Croce, who took care of optimising the original shape of AcrySmart for the digital workflow. The goal was clear: to enhance the communication flow between dentists, technicians and patients, thereby reducing the potential for errors and minimising the need for repeated clinic appointments.



**FIG. 1** The adjustment of the midline. In the first step of Ruthinium Digital Preview it is possible to make all the changes on the project.

## 3D DENTURE GUIDE'S ROLE IN THE DIGITAL WORKFLOW

The integration of the 3D Denture Guide into the digital denture design workflow marks a significant advancement in precision and predictability. This innovative tool comes into play right from the OVD registration stages, where alongside bite rims, dentists receive a calibration tool. This tool is instrumental in marking the upper bite rim with two distinct dots, serving as a foundational reference for aligning future photographs and calibrating the software for smile design, ensuring a seamless transition from 2D planning to 3D execution.

The journey begins with the Ruthinium Digital Preview, a 2D-based software that leverages a comprehensive library of Ruthinium's acrylic teeth in 2D format. This crucial step allows for a realistic preview of the final smile, ensuring that the selected shape and teeth are perfectly aligned with the patient's needs.

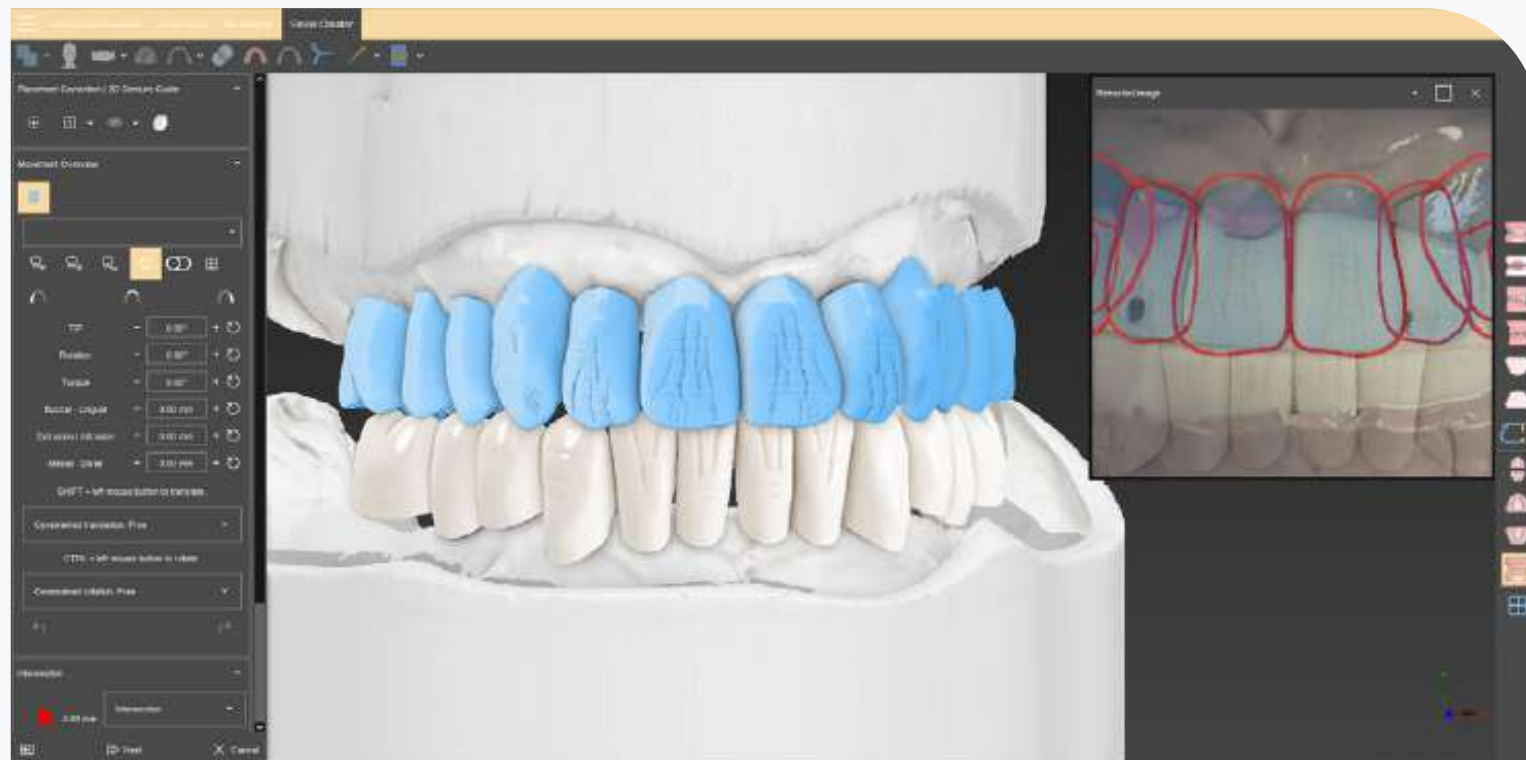
By working within this software, dental professionals can make necessary adjustments early on, especially for the midline and occlusal plane, reducing the likelihood of errors and the need for revisions once the 3D design process begins (Fig. 1).

Following the approval of the 2D preview, the 3D Denture Guide software takes centre stage, facilitating the intricate process of setting up the 3D dental anatomy.

Dental technicians can import 2D images as references to guide the 3D design, ensuring continuity and precision. Importing this picture allows for having the guide picture in front with the 3D anatomy behind, with the possibility to adjust and correct the position of the teeth (Fig. 2).

In the first stage, we follow the guide picture for positioning the anterior upper teeth to avoid mistakes for the midline and the smile line. We then follow the anatomy of the patient at the gingival crest for positioning the posterior according to the preferred school of setup.

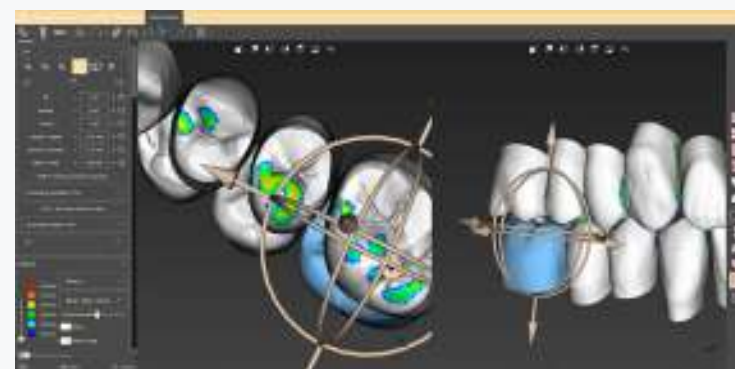
The 3D Denture Guide offers unparalleled control over the denture design process. The software supports the customisation of the teeth placement according to the patient's unique anatomy. The use of manipulator tools offers the flexibility to adjust teeth individually or in groups, ensuring a perfect occlusal fit and aesthetic alignment (Fig. 3).



**FIG. 2** Dynamic set-up. In the 3D Denture Guide software it is possible to import the outline picture of the 2D project to follow the same project approved.



**FIG. 3** Singular adjustment. With the manipulator tool it is easily possible to customize the set-up as per desired preference.



**FIG. 4** Occlusal contact. With live heat map it is possible to check all the contacts and modify the position of the teeth.

At this stage, we can meticulously inspect the arrangement of the teeth, using a live heat map feature for full control over contact points (Fig. 4).

This advanced capability ensures that any potential intersections of teeth are identified and corrected, paving the way for precise and functional denture setup.

#### FROM DIGITAL DESIGN TO PHYSICAL REALITY

Following the detailed setup, the workflow progresses to the generation of the denture base (plaque) and the editing of the gum using freeform tools (Fig. 5).

#### THE DISTINCTIVE ADVANTAGE OF THE 3D DENTURE GUIDE

The 3D Denture Guide distinguishes itself through its integration of its patented system that includes a guide for positioning teeth.

RRuthinium has made a strategic decision to ensure its acrylic teeth are compatible with the majority of CAD software on the market, democratizing access to high-quality materials for all Ruthinium users. This compatibility underscores the company's commitment to innovation and user flexibility.

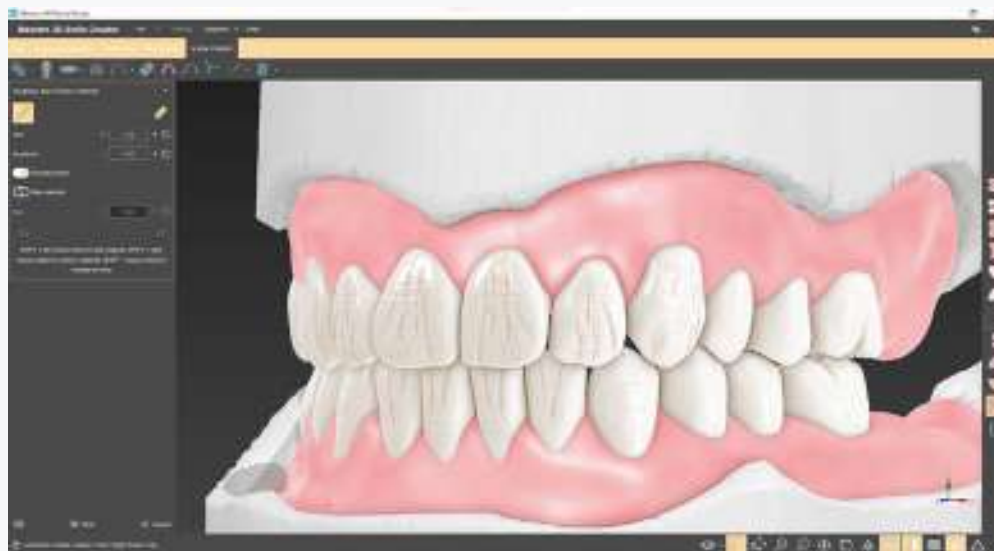


FIG. 5 Final denture design.



FIG. 6 Denture guide. The Denture Guide patent is represented by this splint layer on the teeth with the tripod positioning tool that will help dental technician to glue the teeth in the correct position.

However, the true distinction of the 3D Denture Guide lies in its approach to transforming digital designs into physical realities. Unlike other systems, the Denture Guide employs a patented system specifically for positioning teeth to mirror their digital arrangement accurately. This system uses a specially designed guide on the teeth and a geometric tool, akin to a tripod, that acts as a verticulator (Fig. 6).

This tool is instrumental in ensuring that each tooth is placed precisely as planned in the digital design, providing dental technicians with a reliable reference to ascertain the correct positioning.

#### ENSURING ACCURACY AND SATISFACTION

Once the devices are prepared, they can be fabricated through either printing or milling techniques. Using the process depicted in the image (Fig. 7), the files are printed in a certified definitive material, allowing for the initial placement of the teeth within the gum sockets. To ensure optimal precision during the bonding phase, a specially printed guide is employed. This guide facilitates the accurate positioning of the teeth, ensuring the highest level of control and precision in the final assembly.

### CONNECTING DIGITAL WITH TRADITIONAL: THE ACRYSMART DIGITAL INNOVATION

Originally developed to work within a hybrid system, the Denture Guide used classic acrylic teeth, which were traditionally fixed into the denture base using wax — a method harking back to conventional try-in practices. However, as the demand for a fully digital workflow intensified, the need for a more refined solution became apparent.

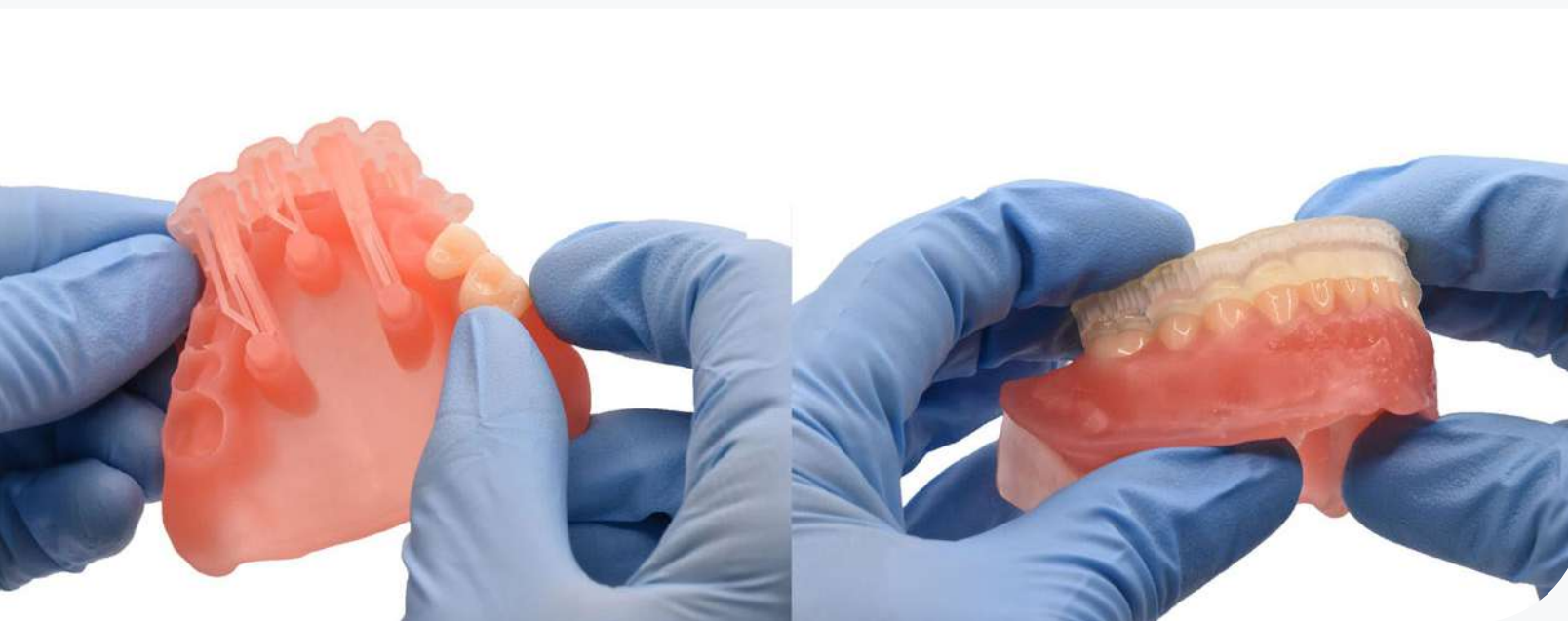
In response to this evolving land-

scape, Ruthinium, in collaboration with Antonello Croce from Metadac FZE, embarked on a project to enhance its existing AcrySmart line.

This collaboration aimed to address the limitations of traditional acrylic teeth when used in a digital context, focusing on a critical aspect of the tooth design – the neck.

In the following pictures, the AcrySmart Digital is labelled with the letter A and the AcrySmart original with the letter B.

**“The spotlight in dental technology has intensively focused on digital dentures, marking a pivotal shift in how professionals and companies approach denture design.”**



**FIG. 6** Final step. The assembly of the 3D Denture Guide system after the 3D Printing of the devices with using AcrySmart Digital teeth.

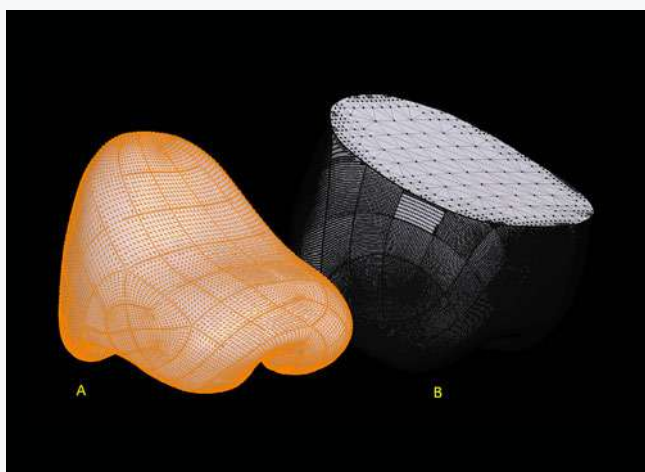
### CHALLENGES WITH TRADITIONAL ACRYLIC TEETH (B)

The original design of acrylic teeth presented several challenges for digital denture design outcomes:

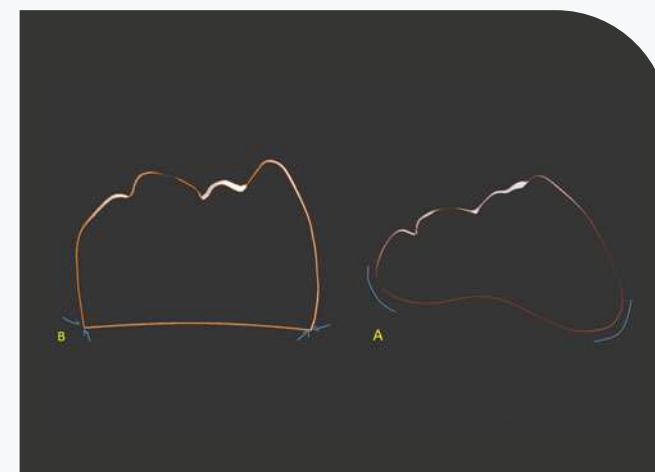
- Sharp angles and undercuts at the neck interfered with digital design processes and fabrication techniques.
- A mismatch in dimensions between the physical teeth and their digital counterparts was evident due to the mark number of the teeth embossed on the neck. This required manual adjustments, leading to gaps and fit issues (Figs. 8B-9B-10B).
- The necessity for manual modifications to achieve a proper fit compromised the efficiency and precision of the digital workflow.



**FIG. 8** Comparison of the design of AcrySmart Digital (A) with AcrySmart (B).



**FIG. 9** AcrySmart Digital: clearly visible how the sharp angle with 90 degree is not anymore present in the AcrySmartDigital (A).



**FIG. 10** AcrySmart Digital: cross section of the two tooth which show the difference on the neck.

- Limitations in milling and printing technologies prevented the accurate reproduction of complex geometries in the gum sockets, particularly at the neck.

#### ACRYSMART DIGITAL: OPTIMISED FOR DIGITAL (A)

AcrySmart Digital emerged as a groundbreaking solution, meticulously engineered to overcome the limitations of traditional acrylic teeth in a digital workflow:

- The redesign focused on eliminating sharp angles and undercuts around the neck, ensuring a smooth surface that is conducive to digital processes. (Fig. 8A-9A)
- By achieving a perfect match between the physical teeth and their

digital models, AcrySmart Digital allows for an exceptionally precise fit with a minimal gap of only 0.08mm.

- This precision eliminates the need for mechanical retention methods, relying instead on chemical bonding to secure the teeth, enhancing both the aesthetic and functional outcomes of the denture. (Fig. 10A)
- The modifications ensure that the teeth can be seamlessly integrated into the denture base using advanced milling and printing techniques, without the need for post-processing adjustments.

#### ANATOMY AFFECTED? THE FUTURE OF DIGITAL DENTURE

The transition to digital denture design has introduced a paradigm shift

in how we perceive and work with dental anatomy, particularly in the absence of gum. Observing a tooth designed for digital workflows without its gingival context might initially strike some as unnatural when compared to traditional acrylic teeth. This reaction stems from a traditional mindset, deeply rooted in the tactile experience of placing teeth into wax and immediately visualising their relationship with the gingiva.

As we look to the future of digital dentures, it is clear that these innovations are not just about overcoming technical challenges; they are about changing mindsets. The shift towards digital dentistry requires an embrace of new materials, technologies and

workflows that prioritise efficiency, accuracy and aesthetic outcomes.

The development of solutions such as the 3D Denture Guide and AcrySmart Digital teeth illustrates the potential for digital technologies to revolutionise denture design, making it more accessible, customisable and efficient than ever before.

