

# Demystifying Computer-Assisted Design

## INTRODUCTION

Accurate recording of physical data is a critical task that dentists perform daily. The restorative workflow begins with preparing the area to be restored. This area, and the surrounding teeth and tissue, must be precisely captured. The definitive restorations are then designed and created.

In the analog world, the data is captured with physical impressions, bite records, and face-bows. Models are fabricated from the impressions. Traditionally, the design phase involves manually waxing the desired final contours on mounted stone models, then manufacturing the final restorative product.

However, data can also be captured digitally with an intraoral scanner, resulting in a digital file. While digital technology captures data in a different way, it is still the same data used in the analog workflow.

Many software programs are available to create a computer-assisted design (CAD), such as CEREC (Dentsply Sirona), 3Shape, Simplant (Dentsply Sirona), and exocad. CAD programs were originally intended for use in the dental laboratory, with the expectation that the CAD design and manufacturing elements would be outsourced to the laboratory and not done in the dental office. Many of these programs are complex and have a steep learning curve to use them correctly.

However, 53% of dentists now use intraoral scanners (IOS). IOS digitally capture 3D images of intraoral hard and soft tissue.<sup>1</sup> To accommodate the increasing number of dentists using IOS in their practices, the hardware, software, and workflows have evolved to give dentists a multitude of options to best adapt the technology to their practice needs.

The design software can now be purchased in segments, so dentists can start with only the CAD portions that apply to their immediate needs. Live courses geared toward the dental team to learn this technology are also available. Once one segment has been mastered, additional modules can be added, allowing the dental team to increase its range of design and fabrication options.

When the CAD portion of the workflow is done in the dental office, the dentist has more control of the functional and aesthetic outcomes. Dentists also appreciate the flexibility of designing and manufacturing on their own time schedules. Patients can view lifelike mock-ups of proposed treatments, which often increases their acceptance of definitive treatment plans.

This article will outline in detail the steps necessary to digitally take a case from data collection through design using in-house



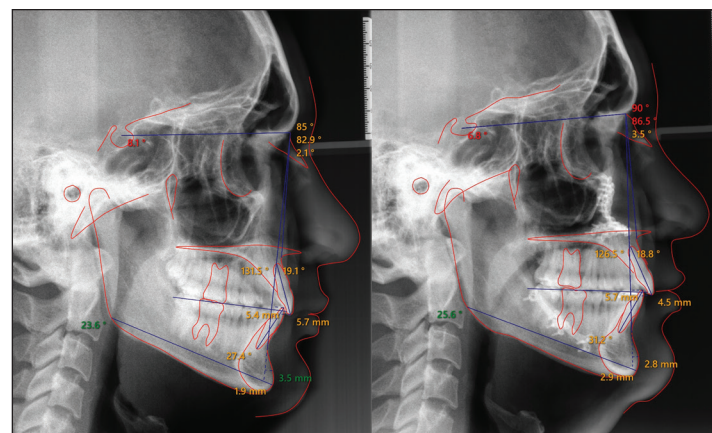
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CAD software. It will also demonstrate the steps necessary to perform a chairside evaluation of the digital mock-up and how to make any needed corrections to enhance the prototypes and final restorations.

## CASE REPORT

A 27-year-old male patient was referred to the office by his orthodontist. Prior to surgery, he had been diagnosed with moderate obstructive sleep apnea and a bimaxillary retrusive malocclusion. The orthodontist aligned the arches with fixed appliances prior to orthognathic surgery. The patient presented postoperatively after a maxillary and mandibular surgical advancement, a LeFort I osteotomy on the maxilla, and a bilateral sagittal-split osteotomy on the mandible.

Treatment goals established by the surgeon and orthodontist included enhancing both the facial aesthetics and improving the airway space (Figure 1).



**Figure 1.** Initial and final traced lateral cephalometric radiographs. Note the improved upper and lower jaw relationships relative to the cranial base.

The patient first presented to the office with orthodontic brackets in place. The orthodontist requested guidance to determine the ideal overbite-overjet relationship to accommodate future restorative materials and to obtain an ideal functional pathway. The patient desired to change the anterior tooth length, shape, and color. Photographs were taken (Figure 2).

A direct composite mock-up was performed chairside to test the aesthetics and function of the proposed increased incisor length. Composite was added to the incisal edge of tooth No. 8. The patient was seated upright, and articulating paper was placed