

Digital Impressions for a Wide Range of Applications

Intraoral Scanners: Precision in State-of-the-Art Restorative Workflows

New materials and the corresponding manufacturing processes have led to the conversion to digital workflows in many dental laboratories. However, many dentists still hesitate at the last step in the digitization of dental implant manufacturing process: digital impressions. This is despite the fact that state-of-the-art intraoral scanners offer high precision and are suitable for a wide range of applications from single-tooth restoration to full-arch rehabilitation and extensive implant work. What could be the reasons for this?



Fig. 2: The iTero Element® Scanner from Align Technology

Precision Backed By Clinical Studies

The reason is not because of the proven accuracy of digital impression technology. Numerous studies have verified that the accuracy of this impression-taking technique is often superior to that of classic methods (study published by DGDOA in 2015 at www.dgdoa.de). This especially applied to single-tooth restorations and small bridge work in the past, but by now scans are also fully equipped to handle full-arch rehabilitations, extensive implant work, and occlusal splint therapy.

The dental laboratory Stroh & Scheuerpflug in Ansbach, Germany, compared around 2,500 restorations made using digital impressions with restorations made using conventional impressions (Fig. 1) within the scope of a four-year study (Florian Schmidt, ZT Labor Stroh&Scheuerpflug, 2016, www.dgdoa.de). The result was clear: the need for remakes due to poor fit dropped from approximately 3.5% for conventional impressions to approximately 0.5% for digital impressions. These numbers are in alignment with the clinical findings of dentists working with digital impressions.

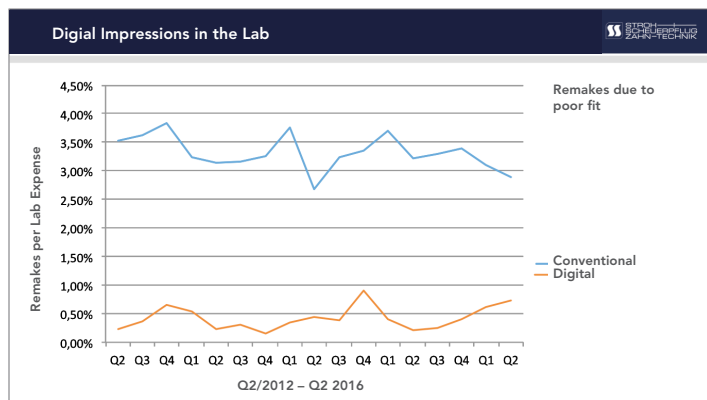


Fig. 1: With digital impressions, significantly fewer remakes because of poor fit are needed.

Main Features in Selecting an Intraoral Scanner

Many companies currently offer intraoral scanners for the dental professional field. The different scanners on the market show significant distinctions in a number of aspects. What are the main criteria that one should consider when deciding which system to use? Attributes such as accuracy, speed of scanning, data availability, handling, interfaces, and software tools are some of the aspects that should be heavily considered.

The iTero Element from Align Technology (Fig. 2) has been on the market for approximately two years. This intraoral scanner is designed as a universal tool for restorative and orthodontic use. In our experience, the triangular representation of the generated scan is clearly different from that obtained using other intraoral scanners (Figs. 3a and 3b). The precise technology and sharp images produced by the iTero Element allows for fabrication of a highly accurate tooth replacement.

There are also a number of helpful software tools that can be used after the actual scanning procedure. Following the scan, the space available for restoration can be immediately reviewed and corrected by means of a color scale (Fig. 8). Rescanning the tooth is not necessary because of the iTero's technology with tooth capture and scanning capabilities. With the cutout function, the area requiring correction can be rescanned. This function also helps with any margin line errors.

Software-Defined Scanning Path

Another major plus of the iTero Element is the predefined scanning path (and the underlying scanning strategy used to define it). Clinical studies have shown that the accuracy is heavily dependent on the quality of the scanning path. In general, the scanning path specified by the manufacturer (Fig. 4) should be used. This is particularly the case when discussing full-arch scans.

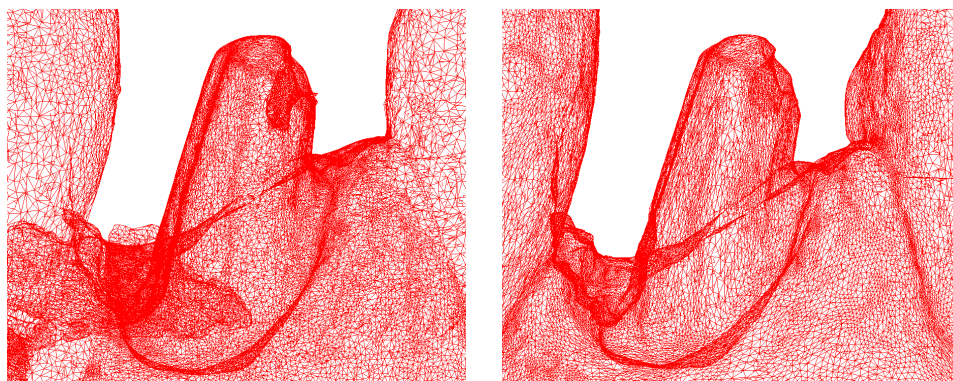
Smart Scanning Strategy

Unlike other intraoral scanners, the iTero Element® allows for impressions for long-term prosthetic restorations in the scanning strategy. The prepared teeth are first individually scanned at a high resolution and then added to a full-arch scan with the preparations. Particularly in the preparation of multiple abutments, this offers the advantage that each abutment can be handled individually in the scan operation and thus the necessary retraction aids can be removed just before the scan. Other intraoral scanners are restricted to scanning the overall situation. As in classic impression-taking, keeping multiple prepared teeth dry and blood-free is a challenging task. Thus, subsequent corrections of the scan through cutout and rescan errors at the preparation margins is necessary. The option of a pre-preparation scan with subsequent cutout of the region to be scanned and addition of the prepared abutment teeth is also not an adequate alternative. For multiple adjacent preparations, this additional preparation is not accurate enough due to the lack of information about the surrounding area.

Full-Arch and Implant Restorations

The special scanning strategy used by the iTero Element also makes it ideal for full-arch scans. This option is appealing not only as a basis for fabrication of dental prostheses but also for occlusal splint therapy or as a basis in fabrication of surgical guides for implants.

Intraoral scanners offer additional advantages for implant impressions. With conventional methods, the transferring of the patient's implant situation is cumbersome and difficult for both the patient and the dentist. The impression is often hard to remove, especially in the molar areas, due to the long transfer posts used. In addition, the precision of the impressions of implants and teeth frequently vary from one region to the next, making remakes necessary.



Figs. 3a and 3b: Compared with a competitive scanner (right), the iTero Element Scanner yields a high-resolution STL file and a high image sharpness (left), which are prerequisites for the high precision and the good fit of the manufactured implant.

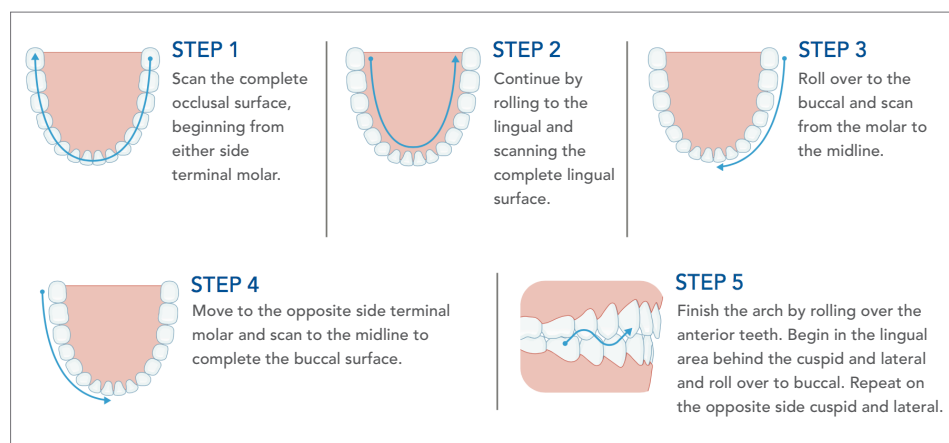


Fig. 4: Maintaining the predefined scan path yields a precise result.



Fig. 5: Scanning strategy used by the iTero Element



Figs. 6a and 6b: Implant impression taken by the iTero Element



Fig. 7: Analysis of the scan by the dentist and the dental technician

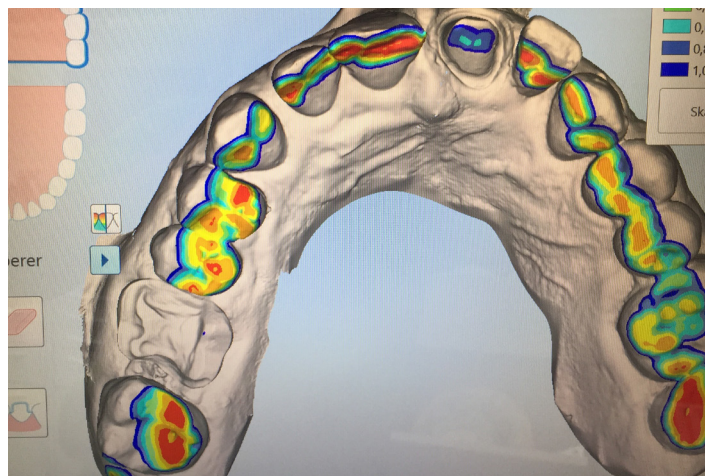


Fig. 8: Display of the height profile following the scan

Digital impressions do away with these problems. The iTero Element® offers a convenient solution (Figs. 6a and 6b) facing the dental industry today with traditional impressions. The arch, including the exposed implant screw, is scanned first to enable representation of the emergence profile. Then a scan post suitable for the implant system and the implant size is screwed in for transfer of the implant position. The scan post is also scanned and automatically added to the first scan. Thus, the dental lab will have the exact position of the implant in the arch as well as information on the surrounding tissue. After the opposite arch impression and digital bite are taken, the impression process is finished. If additional prepared teeth are included in this impression, precise impressions can be taken of each of them separately—as described above—and immediately checked on the screen. In this case, it is crucial that the laboratory have access to the master list of the implant system.

Coordination With the Lab

After the subsequent check, the scan data is transmitted to the Align Technology service team for editing. The data then appears on the Align portal at the iTero certified dental lab and can be processed further there. Through joint definition of the preparation margins by the dentist and the dental technician via remote access on the laboratory computer, the quality of the restorations are also improved (Fig. 7).

Conversion to digital impressions requires conversion of the workflow in both the practice and in the lab. The two partners must discuss the new workflow in detail and each partner must understand the needs and problems of the other.

Conclusion

Digital impressions are state-of-the-art for precise and advantageous patient treatments. The iTero Element from Align Technology is an intraoral scanner designed to be a universal dental practice tool for delivering extremely detailed results, even for large-scale restorations or implants.

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