3M ESPE

Lava™ Scan ST Scanner

Technical Data Sheet

Description

The 3M™ ESPE™ Lava™ Scan ST scanner is a non-contact, optical 3D-scanning device. The operating principle is based on fringe projection combined with triangulation methods. A fringe pattern is projected onto the model's surface and imaged by a video camera under a certain angle. Different views are superimposed to get the entire surface which provides a high density of data for accuracy.

The Lava™ Scan ST scanner is part of the Lava CAD/CAM system including a scanner, a milling machine (Lava™ Form), a sintering furnace (Lava™ Therm) and the respective materials Lava™ Zirconium Oxide (Lava™ Frame) and the veneering porcelain (Lava™ Ceram).

Benefits

- The Lava Scan ST scanner has a much faster scanning time than the current Lava scanner (Lava Scan)
- Excellent marginal fit
- Increased scan length of 47mm will accommodate a larger Lava Zirconium Oxide Frame which will be released in late 2007
- Can be used as a satellite scanner
- Robust and reliable CAD/CAM process
- The Lava Scan ST scanner guarantees an easy to use and safe working process

Indications

The Lava™ Scan ST scanner accommodates all of the current indications for Lava Crowns and Bridges. In addition, the Lava Scan ST scanner is the platform to increase the span width for Lava bridges.

Current indications:

- Crowns
- Splinted crowns up to four units
- 3 and 4-unit bridges with multiple abutments
- 5 and 6-unit bridges with no more than two adjacent pontics and four prepared teeth
- Cantilever bridges up to four units. No single abutments.

Test Results

Scanning Time: The scanning time of the Lava Scan ST scanner is 50% faster than the first generation Lava Scan scanner. In Figure 1a, the different scanning times for crowns with the new and the old scanning device is shown.

[Source: 3M ESPE Internal measurement 2005]

In addition, milling centers also found the new scanner to be faster than the first generation scanner (Figure 1b). Eight milling centers evaluated the scanning time by preparing 1,100 crowns and 300 bridges.

[Source: 3M ESPE Application test December 2005 in Germany, USA, Austria]

Figure 1a

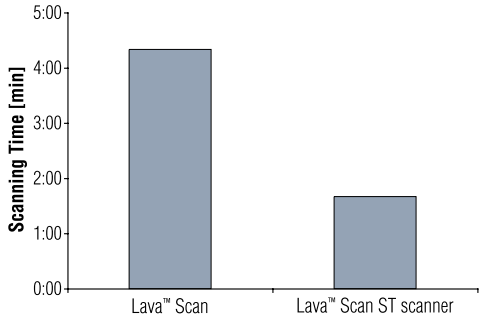


Figure 1b

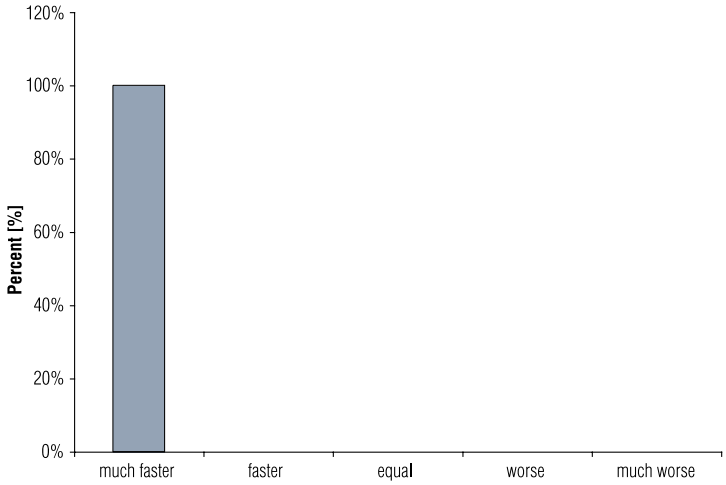


Figure 1a and 1b: Scanning time of Lava™ Scan compared to Lava™ Scan ST scanner.

Test Results (*cont.*)

Marginal Fit: The marginal fit of the new and old scanning device has been compared (Figure 2a and 2b). Four different models of four splinted crowns have been scanned with the respective device, milled with the Lava™ Form milling machine and subsequently cemented on the scanned dies. The restorations were embedded in acryl and sectioned faciolingually and mesiodistally. A stereomicroscope and special analytical software (analysis, Soft Imaging System GmbH) were used to determine the marginal opening (MO) and absolute marginal opening (AMO) of the cross-sections for each abutment. This shows that even with a 50% reduction in scanning time, the Lava Scan ST scanner has the same level of accuracy as the first generation scanner.

[Source: G. Hertlein et al. (2006) IADR #0067]

The same clinical situation of a 3-unit bridge has been scanned and milled by the CEREC® Inlab, Etkon es1, Cercon Brain and Lava CAD/CAM system (Figure 3). The restorations were cemented with glass-ionomer cement on the master dies and cut twice in order to determine the marginal fit by light optic microscopy. Three-unit bridges scanned with Lava Scan ST scanner and milled by the Lava System showed an excellent marginal fit.

[Source: F. Beuer, T. Fischer, K.-J. Erdelt, H.-U. Aggstaller, K. Spiegl, W. Gernet; (2005) IADR #1336 In-vitro Study Marginal fit of Lava restorations; Dr. F. Beuer, K.-J. Erdelt, J. Schweiger, Industrial report]

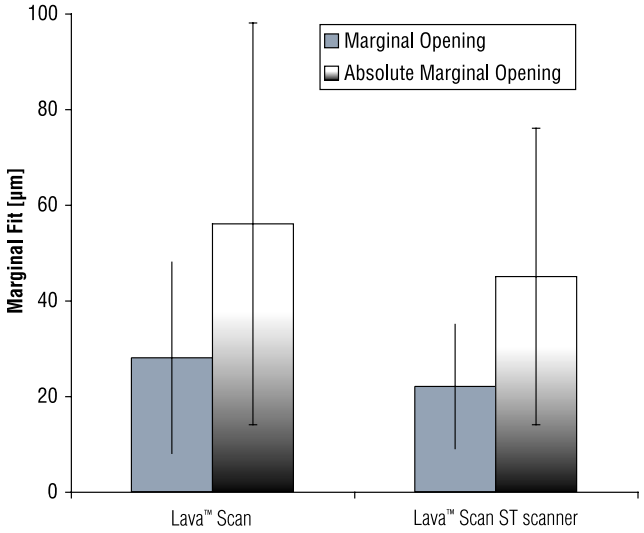


Figure 2a: Marginal opening and absolute marginal opening of 4-splinted crowns scanned by the Lava™ Scan and the Lava™ Scan ST scanner. By reducing the scanning time, Lava restorations show the same excellent marginal fit.

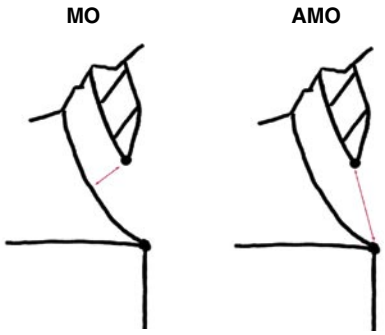


Figure 2b: MO = Marginal Opening, AMO = Absolute Marginal Opening

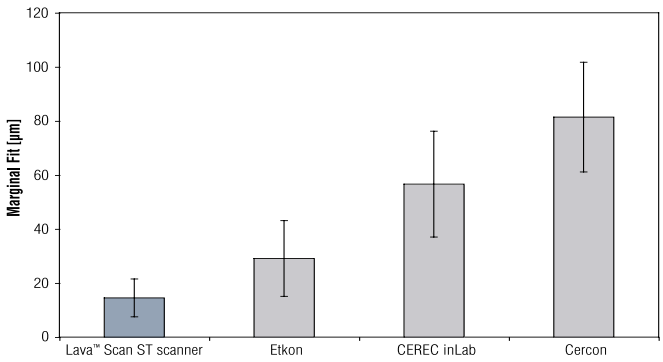
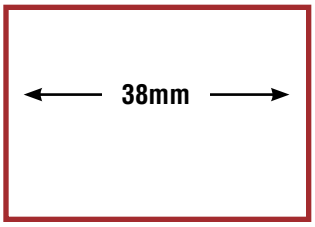


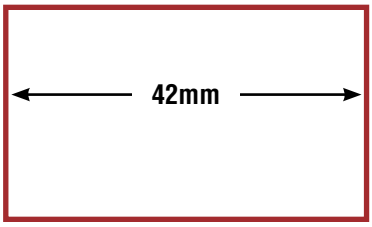
Figure 3: Marginal Fit of 3-unit bridges scanned and milled with different systems. Lava™ Scan ST scanner shows a good marginal fit in comparison to competitor systems.

Test Results (*cont.*)

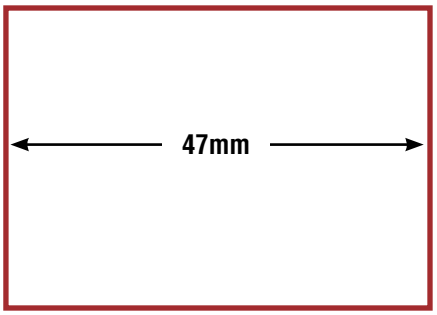
Scan Length: The new Lava Scan ST scanner was developed with an increased scan length of 47mm. The latest camera technology was used with a higher resolution leading to a larger scan volume.



Scan window of Lava™ Scan



Scan window of Lava™ Scan ST scanner 1st Quarter 2007



Scan window of Lava™ Scan ST scanner 4th Quarter 2007

Robustness: A lifetime simulation was used to test the robustness of the Lava Scan ST scanner. The long-term use of the scanner of more than 15 years (34 scanned restorations per day, 250 working days per year) was simulated with all mechanical devices in order to ensure a robust design.

[Source: 3M ESPE Internal measurement 2006]

Triangulation with fringe projection:

For twenty years, optical triangulation has been one of the most common methods for acquiring data. However, it is only in the last few years that its speed and accuracy has increased with the development of imaging sensors like CCD.

The distance measurement is based on the comparison of equal triangles. By the known positions of the light source and the detector (distances and angles) the distance to the object can be calculated for each point (Figure 4).

The triangulation methods used in a scanner differ on the structure of the light source (point, stripe, multi-point or multi-stripe) and the scanning method (move the object or move the hardware). In the case of a point laser as the light source, the surface of the object is scanned point after point in order to calculate the exact distance (*Laser scanner*). There are also laser projecting stripes on the object to determine a defined area at the same time. *White light triangulation with fringe pattern* has the advantage to calculate the distance of the object not only at one point, but capturing the whole image from one perspective at the same time. Images are acquired from different perspectives and finally superimposed in order to get the entire 3D data. This data acquisition is very fast and thrifts are not influencing the accuracy. In this way data density is high and accuracy is achieved.

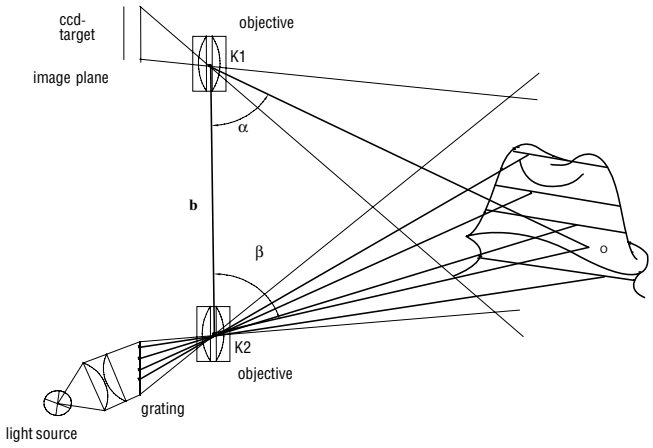
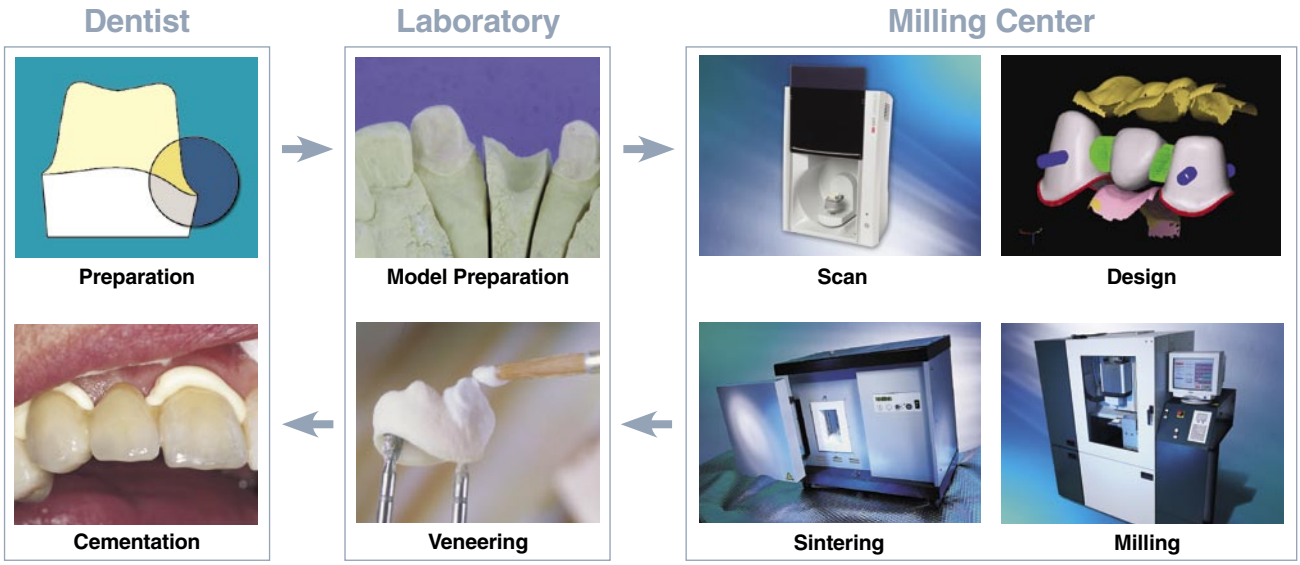


Figure 4: Optical triangulation — By the known positions of the light source and the detector (distances and angles), the distance to the object can be calculated for each point.

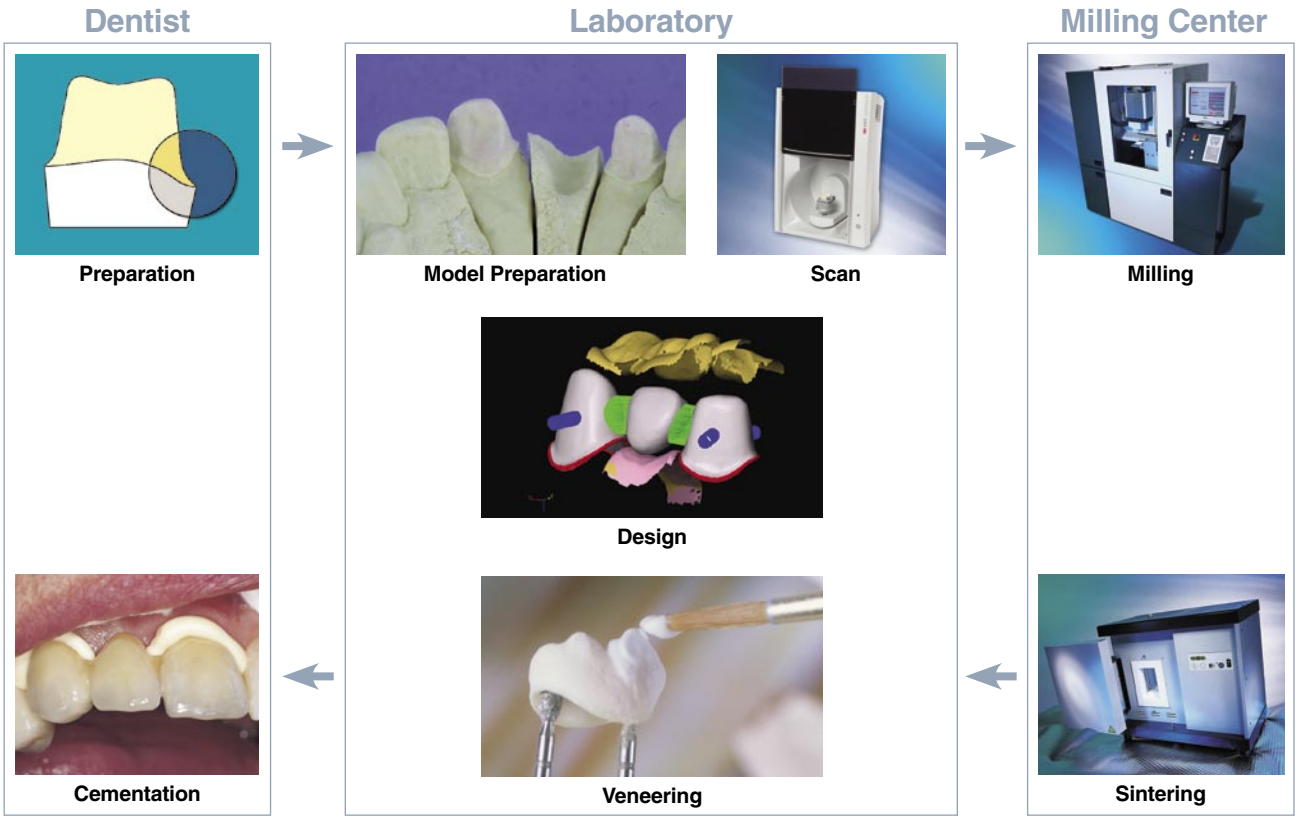
Dental Lab Outsources to Authorized Lava Milling Center (ALMC)

This is the current workflow for Lava Crowns and Bridges. In this model, the dental lab does not invest in any hardware or software.



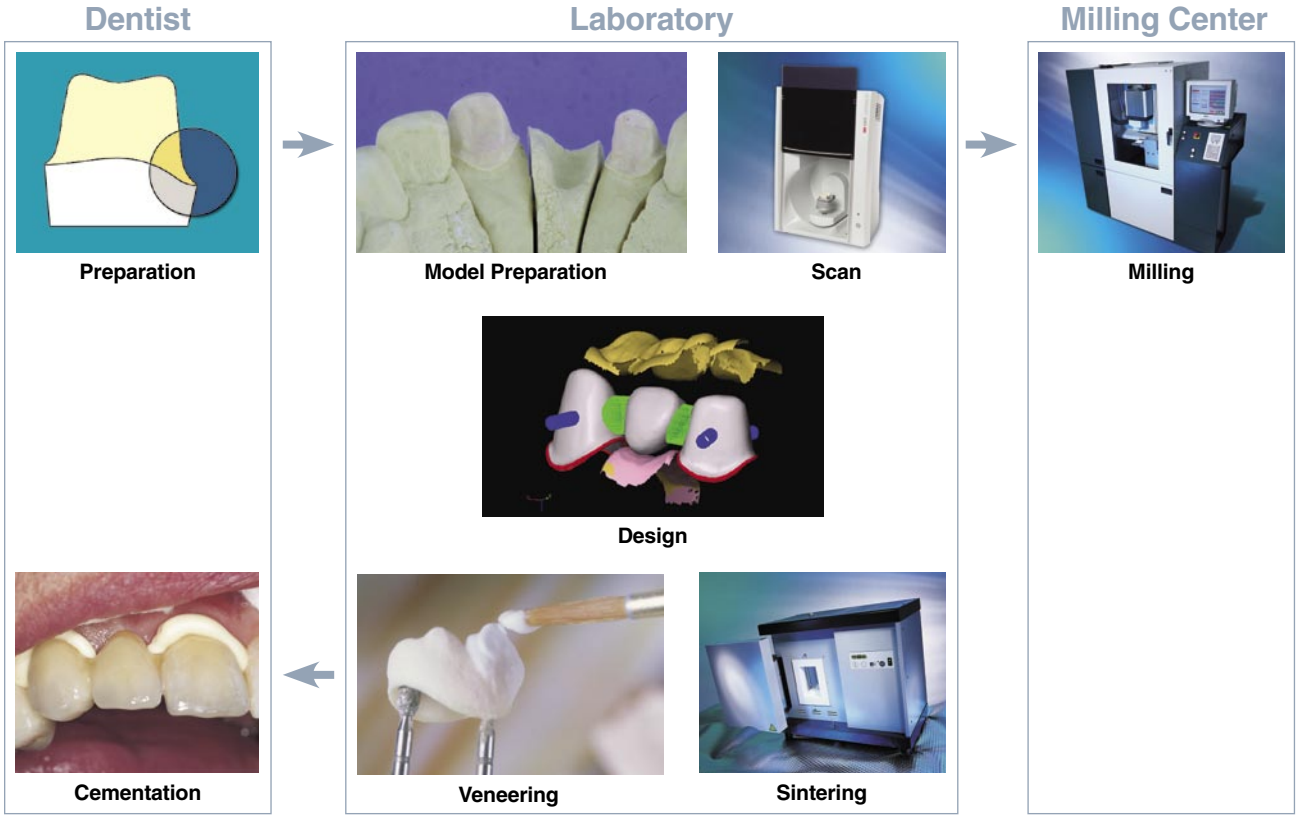
Dental Lab is an Authorized Lava Design Center

The dental lab uses the Lava Scan ST scanner to scan and design the coping or bridge framework. The CAD file is electronically sent to the Authorized Lava Milling Center for milling and sintering.



Authorized Lava Design Center (ALDC) Plus Oven

The ALDC purchases the sintering furnace. With this business model, the lab scans, designs and finishes the restoration. With this model, the level of design control by the ALDC is maximized.



Technical Specs

Scan Window: Allows digitialization up to 6 units and a total length of 42mm. Total scan window 62 x 46mm

Scan Time: Average scan time is 1.40 minutes for a single crown as well as for a 3-unit bridge

Scan Type: Non-contact, optical scanner with fringe projection triangulation for high accuracy

Scan Handling: Ergonomic design and convenient handling with one hand height adjustment

Scanner Size:

Width	Depth	High	Weight	Line Voltage	Frequence	Power
545mm	465mm	800mm	45kg	100 – 240 Volt	50 Hz – 60 Hz	250 Watt

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