CAD/CAM in Operative Dentistry

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?What is it

- Computer Aided Design – Computer Aided Manufacturing
- Crown availability much faster than lab
- Able to manufacture:
  - Inlays
  - Onlays
  - Full Coverage Crowns
  - Veneers

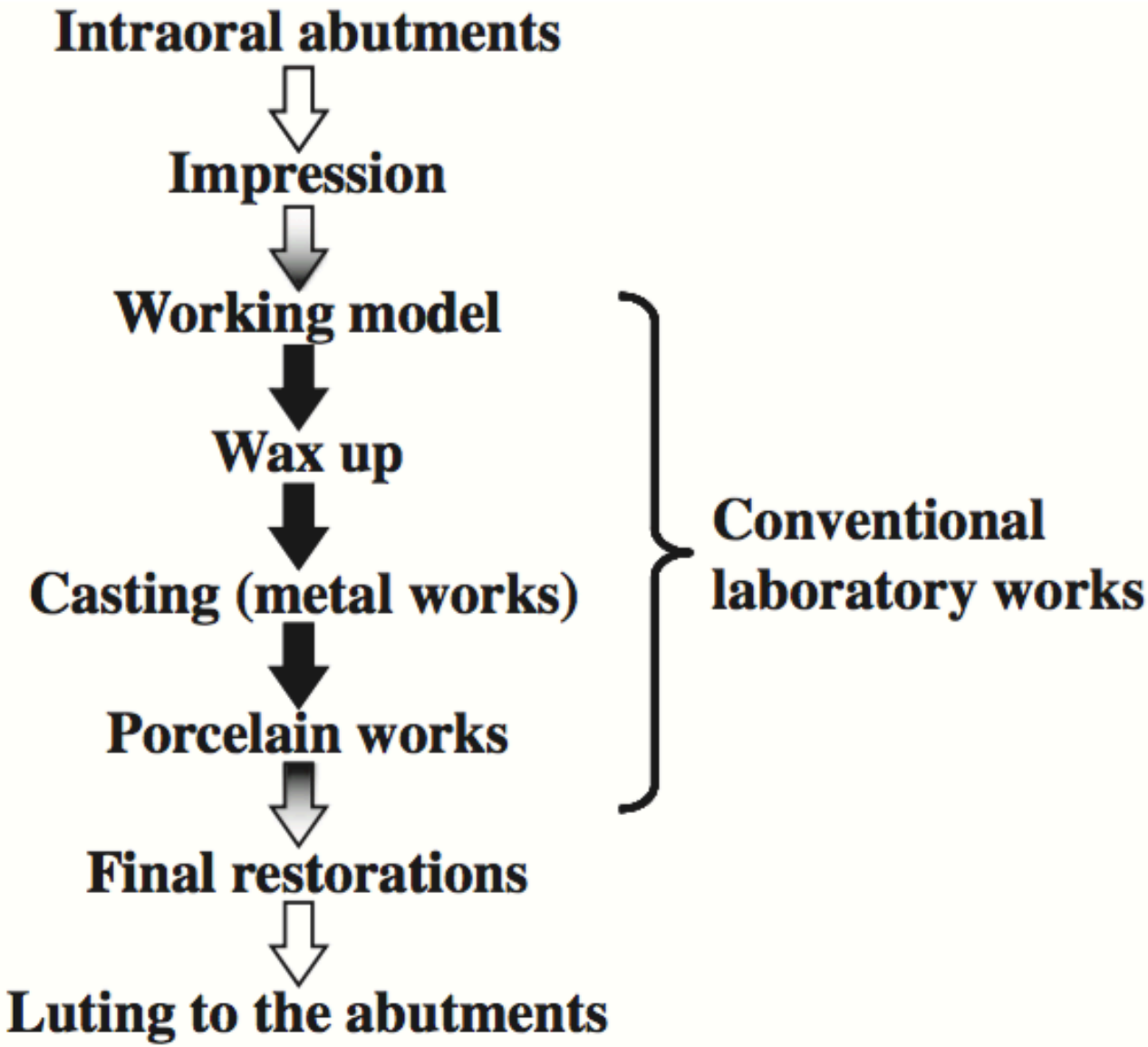


Fig 1. Conventional fabrication process of crown-bridge restorations.

- The advent of computer-aided manufacture to control milling machines has facilitated the use of extremely strong ceramic materials such as pure alumina or zirconium or yttrium-stabilized zirconium to form copings which fit over the prepared die and support more aesthetic feldspathic porcelain.

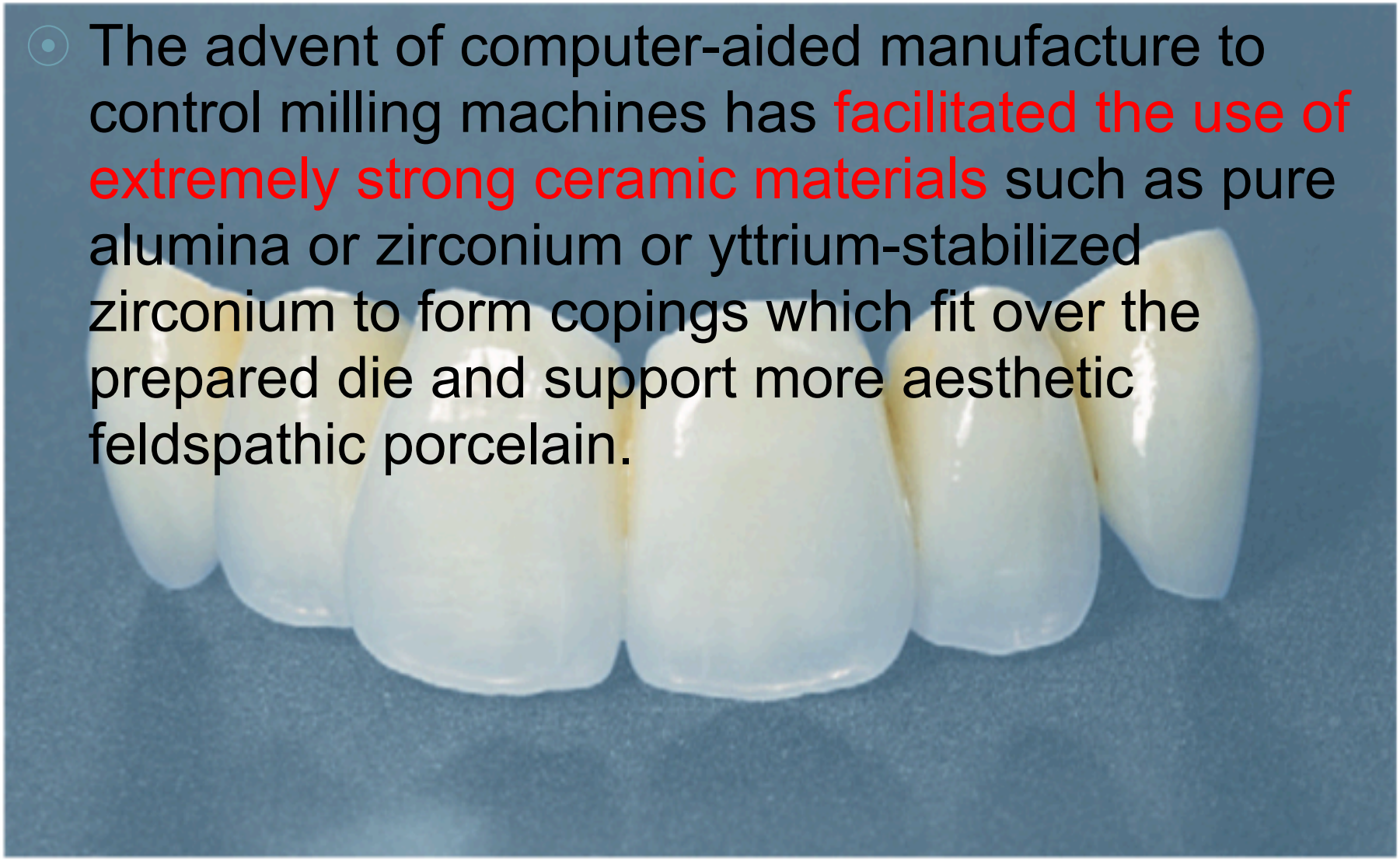


Figure 19.28 All-ceramic six unit fixed–fixed Lava bridge. *(Courtesy of 3M ESPE)*

History……

- 1950s: The genesis of (CAD/CAM)
- 1970s and 1980s: Used in industries.
- 1980s: The first dental CAD/ CAM were CEREC (Sirona) and Procera (Nobel Biocare).

Since that time, dental CAD/CAM has evolved to include more sophisticated techniques, improved esthetic results, and a wider variety of options for the clinician and the laboratory technician.

Fig. 1

Prof Werner Mörmann and Dr Marco Brandestini from Zurich University created the first CAD/CAM inlay from a silicate ceramic

Dental CAD/CAM components:

1. **A scanner or digitizing instrument that transforms physical geometry into digital data (Digital impressions).**
   - Scan in mouth
   - Scan impression
   - Scan cast

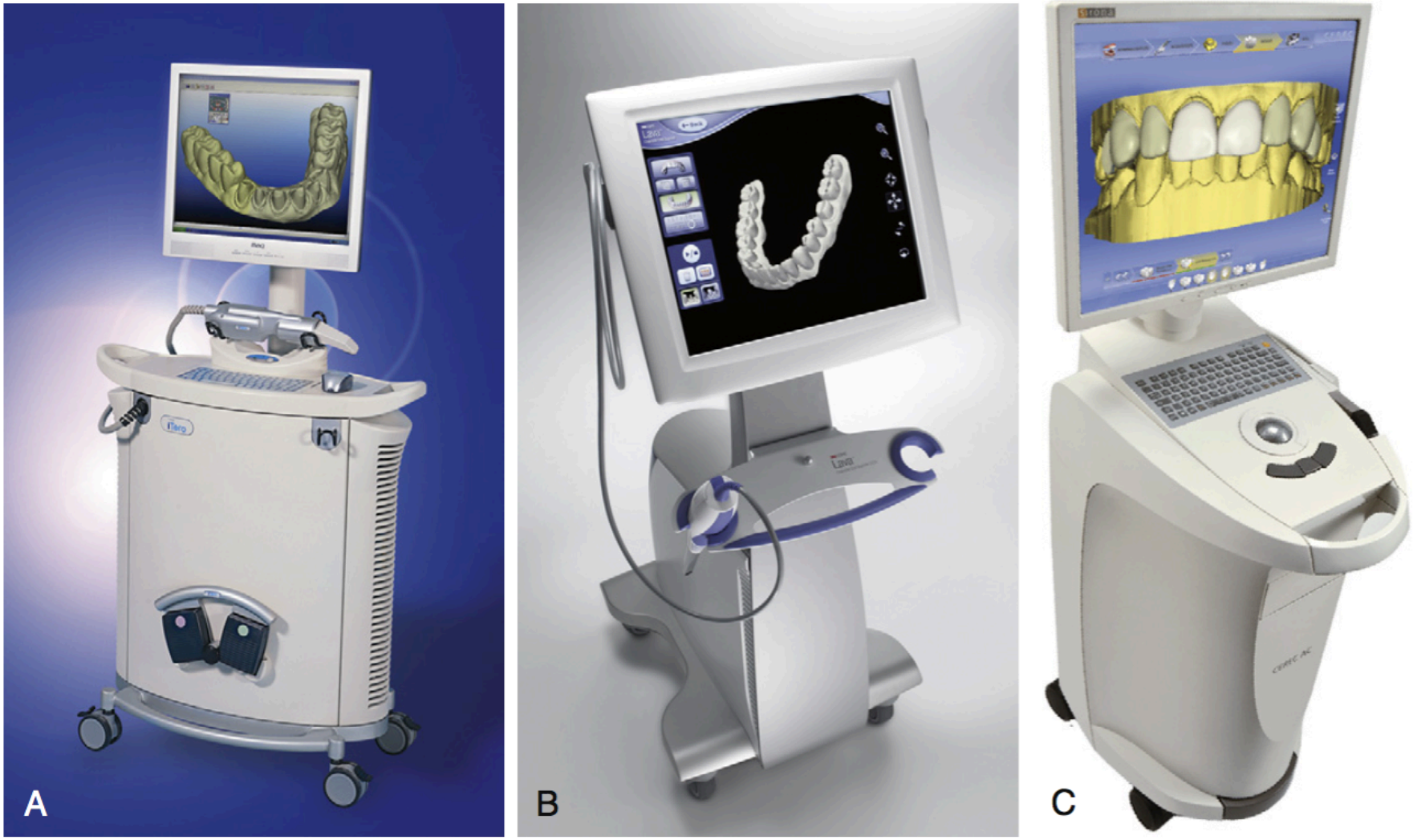


FIGURE 14.2 **Digital impression systems. A,** iTero. **B,** Lava Chairside Oral Scanner C.O.S. **C,** CEREC AC. *(**A,** Courtesy of Cadent, Inc., Carlstadt, NJ; **B,** Courtesy of 3M ESPE, St. Paul, MN; **C,** Courtesy of Sirona, Charlotte, NC.)*

Dental CAD/CAM components:

2. **Software that processes the scanned data and creates images of the digitized object. Some systems then enable restorations to be designed for the digitized object (Design software).**

Figure 11. Virtual design of posterior crown

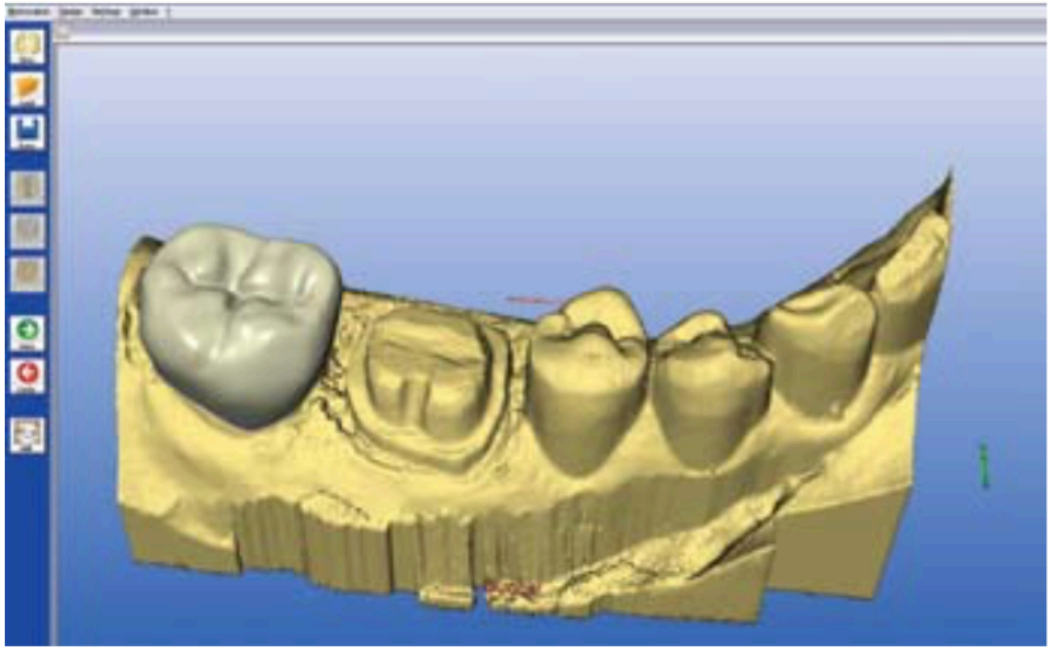
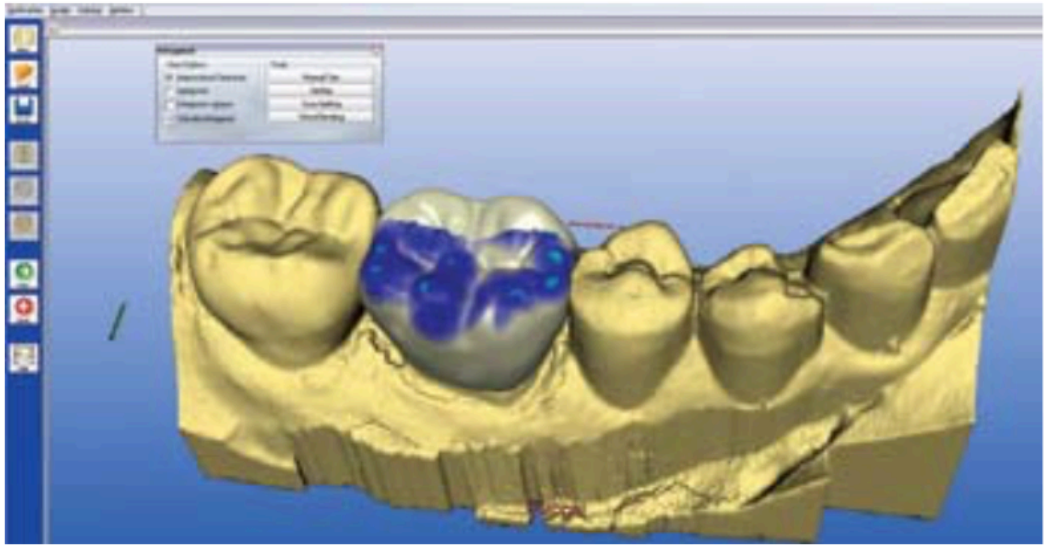
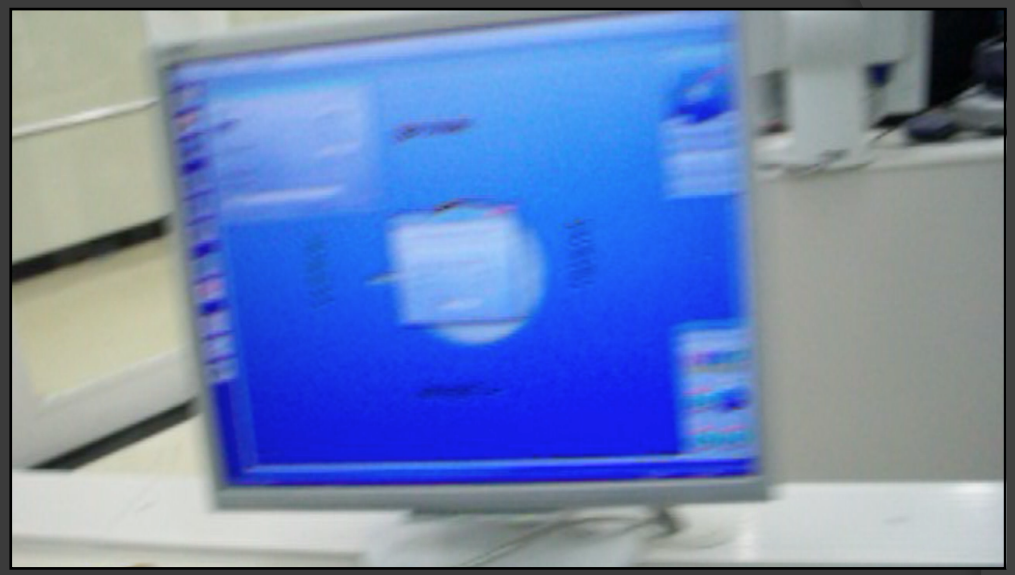


Figure 12. Digital image of occlusal virtual contact placement (light blue) designed from bite registration



Dental CAD/CAM components:

3. **Fabrication technology that transforms the digital data of the restoration into a physical product.**



- **Different systems place the fabrication technology in the dental office, dental laboratory, or centralized facility (milling machines).**

Figure 24. CAD ceramic blocks used for the restorations

Figure 25. Milled restorations

Figure 11.15 The Lava milling machine. The white rectangul zirconia blanks can be seen stacked up to the left, the millin machine is to the right.
(Courtesy of 3M ESPE)

Figure 24. CAD ceramic blocks used for the restorations

Figure 25. Milled restorations

Techniques…..

1. **Chairside CAD/ CAM Technique :**

- Involves scanning the preparation and then fabricating the restoration in the milling device (CEREC 3, Sirona; E4D, D4D TECH).
- You must ensure that all margins of the cavity are captured by the scan and visualized.

Table 2. Chairside CAD/CAM technique

Advantages
One-visit fixed restorative procedure
No impression making
No temporary restoration required
Reduced potential for tooth sensitization
No laboratory costs
No model or die pouring
Accuracy
Less opportunity for error compared to traditional technique
Aids prep visualization
Projects a state-of-the-art image
Disadvantages
Soft tissue management more critical than with traditional technique
Depending on the material and patient, customization may be required
High learning curve
Higher production required to cover capital investment

Techniques…..

2. **Integrated Chairside —Laboratory CAD/ CAM Technique:**

- The clinician either can scan the preparation directly and then send the scan to the laboratory, or can take a traditional impression, after which a stone model is poured and the laboratory scans the stone model.

Table 3. Chairside-laboratory integrated technique

Advantages
Automates steps or all of fixed restorative fabrication
Accuracy
Less opportunity for error compared to traditional technique
Opportunity to subcontract CAD/CAM to avoid capital costs
Opportunity to focus on artistic ceramics
Scanned image transferred directly to the laboratory from the office
Reduced chairside time
Team approach to fixed restorations
Disadvantages
Requires two visits

Figure 15. Flow chart: CAD/CAM methods and options

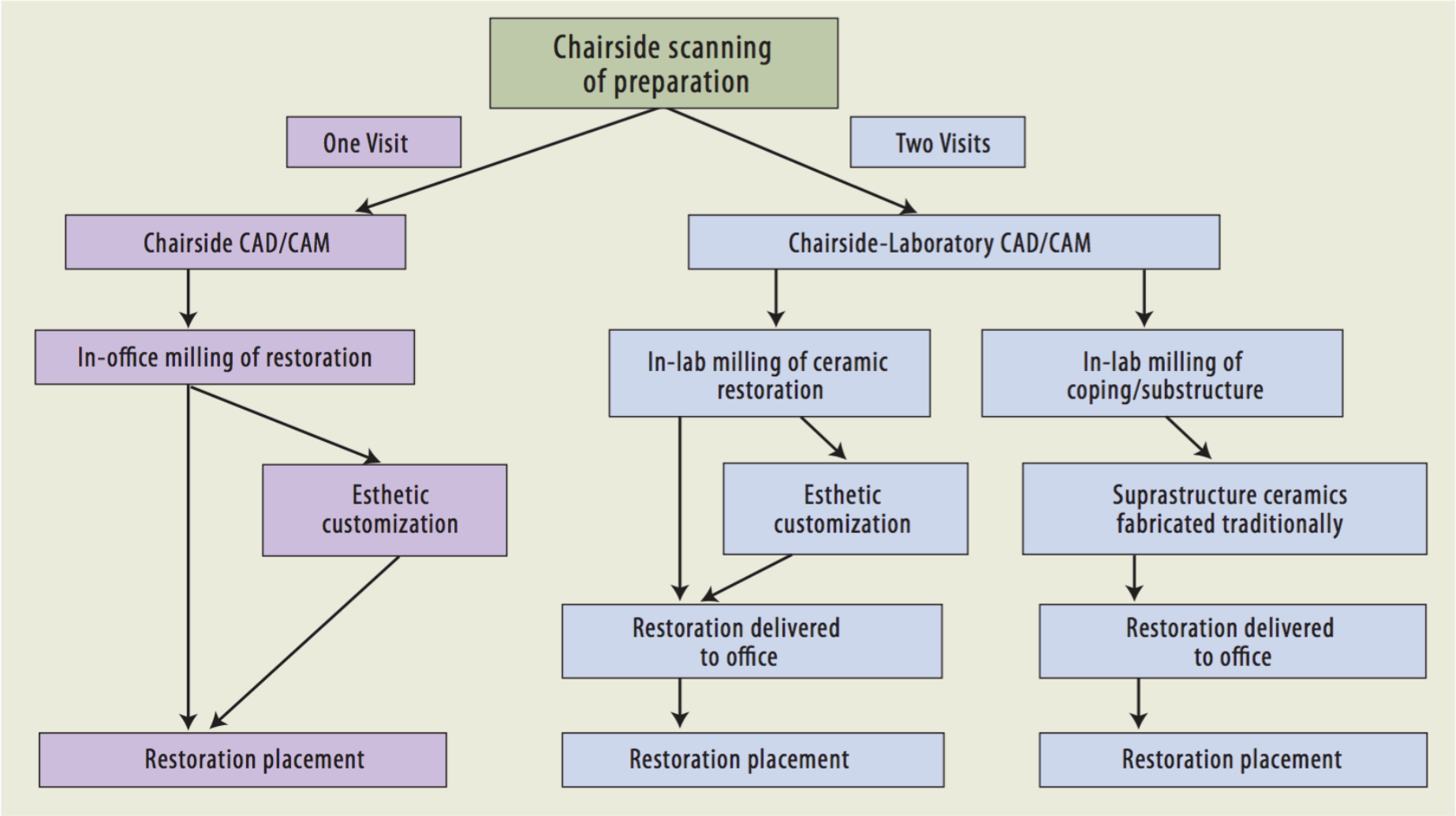


Table 1. Popular CAD/CAM systems available for the fabrication of zirconia frameworks

CAD/CAM system (Manufacture)	Dizitizing Method	Restoration type				Material						Central machining centre
		In	Veneer	Cr	Br	Resin	Titanium	Gold	Ceramic	Alumina	Zirconia	
Etkon (Etkon AG)	PSD/Laser			○	○	○	○	○	○		○	○
Everest (KaVo electrotechnical work GmbH)	CCD/White light	○	○	○	○		○		○		○	Available
Lava (3M ESPE Dental AG)	CCD/White light			○	○		○		○		○	Available
Pro 50, WaxPro (SYNOVAD)	CCD/Color light			○	○		○	○	○		○	○
Procera (Nobel Biocare Germany GmbH)	Touch Probe		○	○	○		○		○	○	○	○
Hint ELs DentaCAD systeme (Hint-ELs GmbH)	CCD/White light			○	○	○	○				○	Available
KATANA system (Noritake dental supply co., LTD)	CCD/Laser			○	○						○	Available
Cercon smart ceramics (DeguDent GmbH)	CCD/Laser			○	○						○	Available
CEREC3/inLab (Sirona Dental of system GmbH)	CCD/Laser	○	○	○	○				○		○	Available
DCS Dental (DSC Dental AG)	PSD/Laser	○	○	○	○	○	○		○		○	Available
ZENO® Tec System (Wieland Dental & Technik GmbH)	CCD/Laser			○	○	○	○			○	○	Available

Australian Dental Journal 2011; 56:(1 Suppl): 97–106

TABLE 14.3 Comparison of Restorations Made by Digital Impression vs. Elastomeric Impressions

Parameter	Digital Impression (% perfect)	Elastomeric Impression (% perfect)
Quality of contacts	62	46
Fit	92	71
Occlusion	74	48

Modified from Farah JW, Brown L: Dent. Advis. Res. Rpt. 22, 1-3, 2009.

Thank You!!!!!!!!!!!!!