GENERAL APPLICATIONS OF CAD/CAM

IN DENTISTRY

LECTURE OUTLINE :

Introduction to the CAD/CAM system

Roles of CAD/CAM in dentistry

Different components of the CAD/CAM system

REFERENCE:

The doctor is going to provide us with three articles as a reference for this lecture

**CAD/CAM : computer aided design computer aided manufacturing**

As we all know nowadays technology is being widely used in many fields including dentistry and people in general tend to use technology to get things done more accurately and faster .

Computer aided manufacturing was first used in many other industrial works just like how zircona was first used in the medical field and later on introduced to dentistry .

CAM/CAM means that the computer is going to help us design our work and also help in the creation and making of this design by the use of specific tools.

Now generally speaking the steps of conventional bridge preparation are as follows :

1. Primary impression and cast
2. Tooth preparation
3. Impression making
4. Pouring of a cast (working models and dies )
5. Wax up and building of the teeth
6. Casting (exchanging of the wax by metal )
7. Polishing of the metal and placement of porcelain in case of PFM

Errors may occur in any of these steps so to lower the chance of error CAD/CAM was used to achieve good fit , occlusion , anatomy , and design also chair time adjustment was reduced by 33% compared to the conventional way and in case of dental visits they were reduced since you can provide your patient with the cr/br within 10 mins after planning the design .

CAD/CAM is used to make any fixed prosthesis including :

1. Inlays
2. Onlays
3. Crowns
4. Veneers
5. Bridges

* CAD/CAM has facilitated the use of extremely strong ceramic materials in the full ceramic restorations meaning we used to us feldspathic ceramic materials for the fabrication of these prosthesis which cant be used in areas of heavy occlusal loads so advanced ceramics were introduced which include lithium disilicate , zirconia , alumina , and Leucite reinforced that can be used in all ceramic restorations which gave the advantage of aesthetics compared to the metal coated ceramic restoration .

The problem with those advanced ceramics more specifically zirconia and alumina is that they are very hard and tough materials to work with, so while manufacturing them the normal burs used usually can’t cut through them.

CAD/CAM made zirconia and alumina easily handled and increased their use. it also introduced their use as frames instead of metals in case of pfm so you have a zirconia or alumina frame condensed with a layer of feldspathic ceramic.

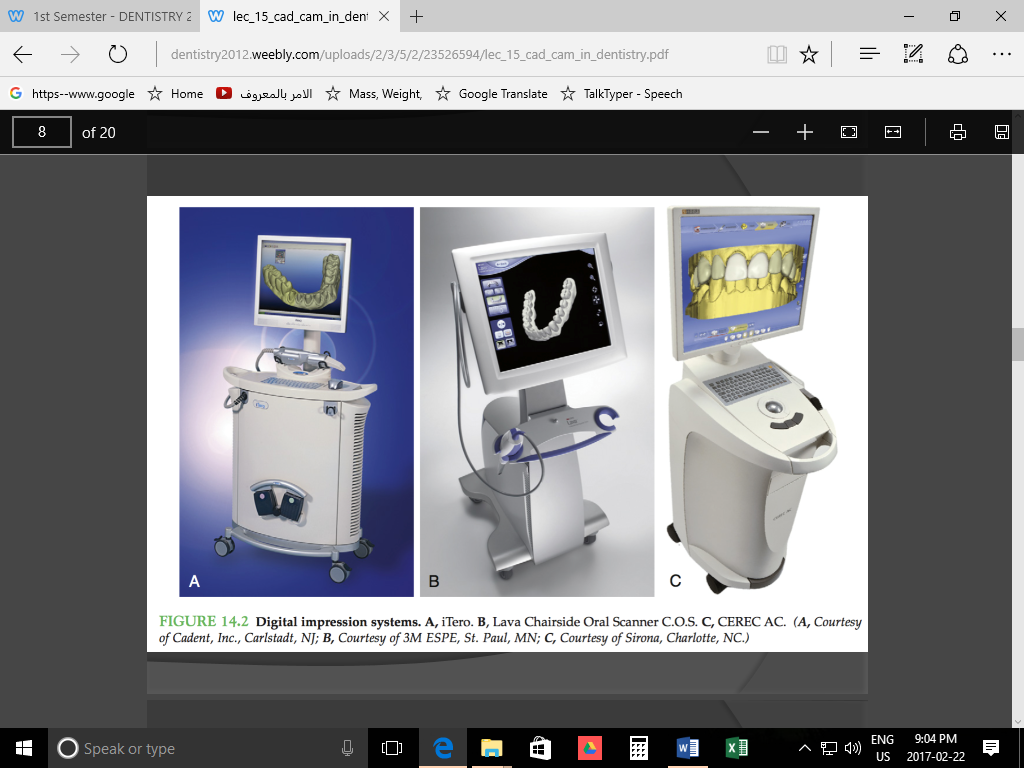
History of cad/cam :

They started using it since the 50’s in industrial work by linking a computer to a machine and transferring the numerical data from the computer to an actual object. In the 70’s and 80’s the industrial revolution happened achieving more development in the computer software’s being used.

Then in the late 80s two scientists Prof Werner Mörmann and Dr Marco Brandestini from Zurich University created the first CAD/CAM inlay from a silicate ceramic using The first dental CAD/ CAM called CEREC (Sirona) which was an in office device where you use it in your clinic; so you take the impression scan it than plan a design and the milling machine then gives you your restoration all in the same dental clinic.

After that Procera (Nobel Biocare) cad/cam was made it differs in that this device isn’t an in office one its an in laboratory type. what you do is you take a digital impression of your preparation then send it by the internet to procera compony which has a system to produce a dye and a final restoration and then send it back to you

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.

Dental CAD/CAM component:

1. A scanner or digitizing instrument that transforms physical geometry into digital data (Digital impressions). So you either Scan in mouth using specific cameras or Scan an impression or Scan the cast which ever you choose based on the system your using you must keep in mind that you should scan all parts of the preparation.
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). So you have a 3d model of the tooth or teeth that you have scanned and can apply your design to it and shape it as needed. It also helps in the occlusal surface forming making it more accurate since you relay on contact points or surfaces that have been scanned rather than the pts bite
3. Fabrication technology that transforms the digital data of the restoration into a physical product giving you your restoration.

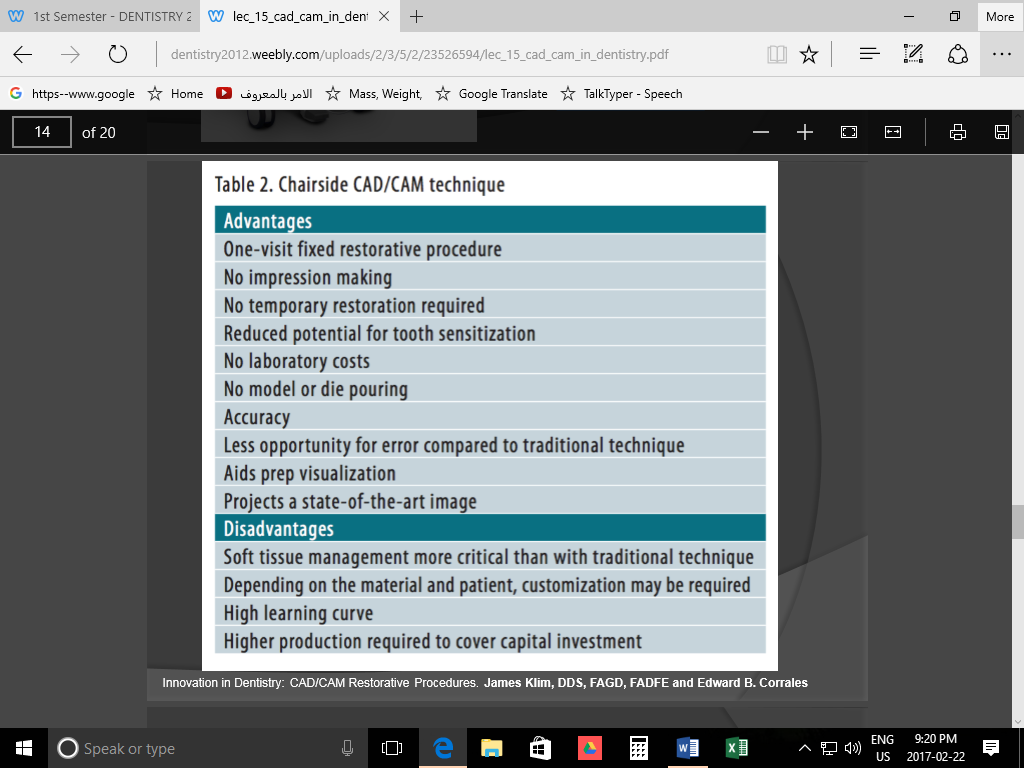
• Different systems place the fabrication technology in the dental office, dental laboratory, or centralized facility (milling machines).

Techniques of CAD/CAM:

1. Chairside CAD/ CAM Technique “in office “:

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

The following table lists the advantages and disadvantages of this technique:

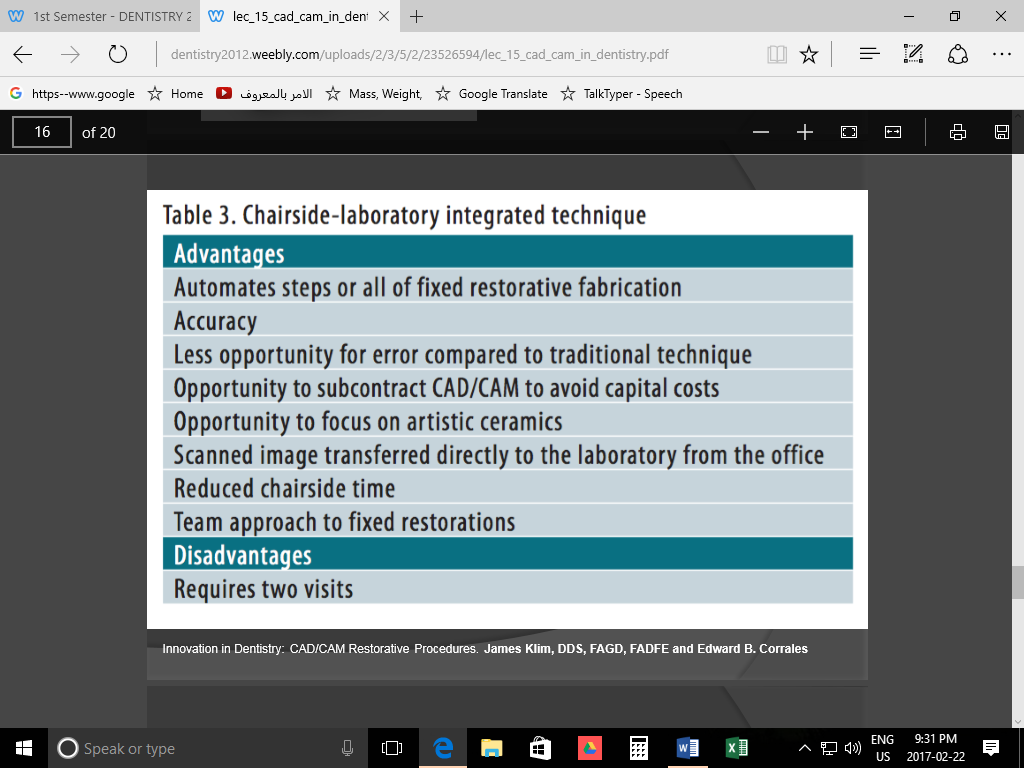


Notes: soft tissue management means that you have to correctly place retraction cords. Customization that is required concerns the shade of the restoration since some machines work on a single block with a single shade.

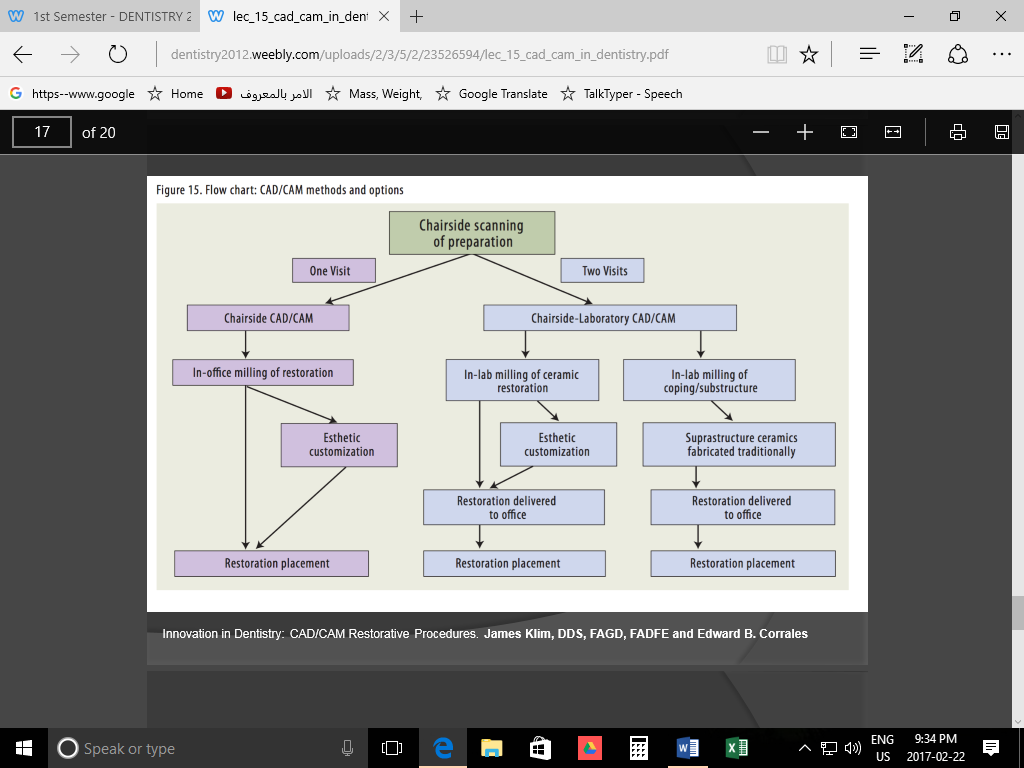
1. Integrated Chairside —Laboratory CAD/ CAM Technique:

* 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.

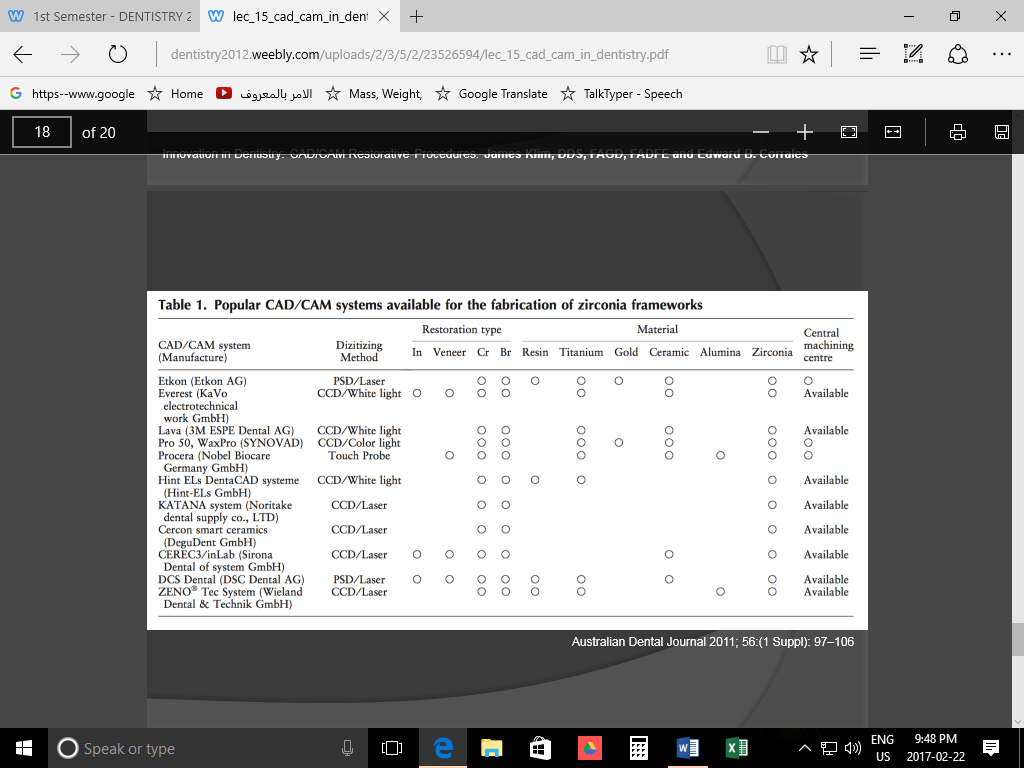
The following table lists the advantages and disadvantages of this technique:



The following is a flow chart summerizing the deffrent methods and options that we have :

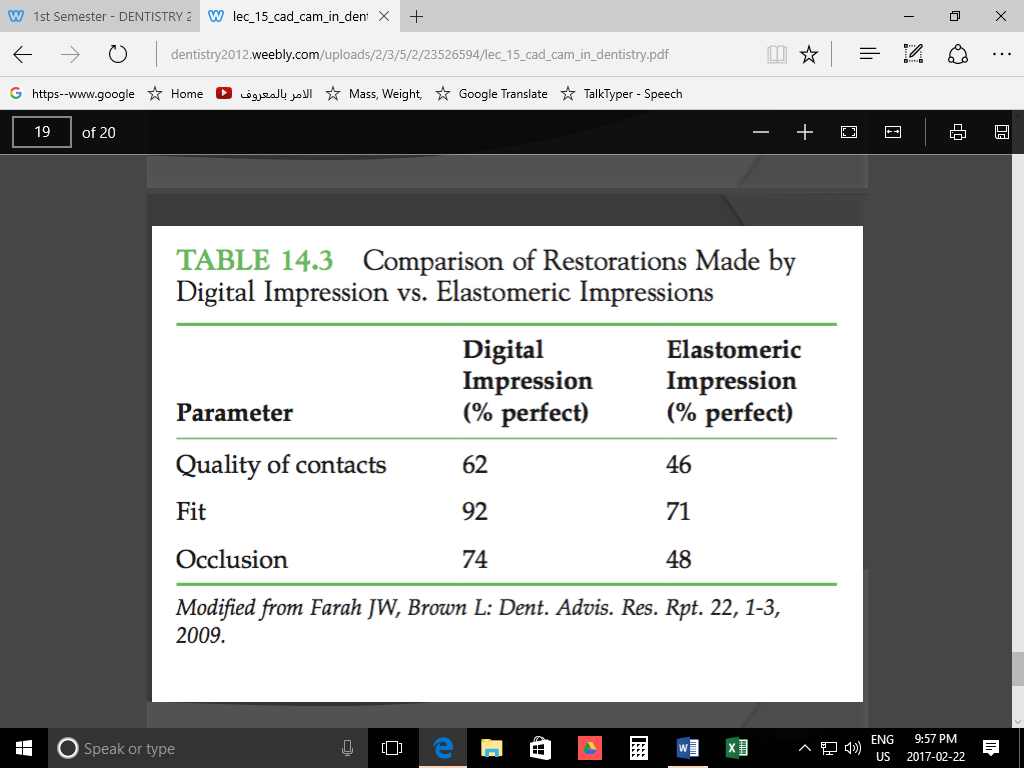


The followin table summerizes some popular cad/cam systems and the type of restoration and material that can be used with them :



Note: I don’t know if it is included or not and what to know or not the doctor just read the table!

The following table is based on a study done to compare digital and conventional restorations as you can see digital restorations are almost twic or less more acurate than those of the conventinal



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