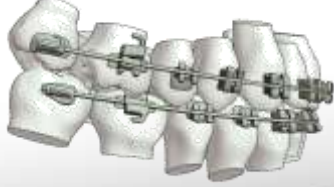


The latest in intra-oral scanners: Proper Use and benefit in the laboratory



3-D Technology



3-D Scanners make exact replications



3-D Scanning in Dentistry

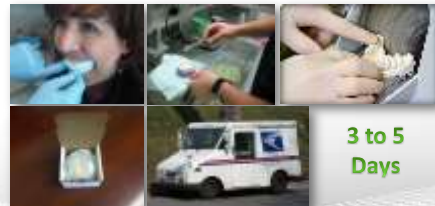
- 3-D Technology has drastically changed dentistry in the last 20 years and more change is expected in the next 10 years
- It is estimated that in 2020 80% of all restorations will be delivered with milling machines in a doctors office
- What impact will the technology will have on orthodontics?



Scanning verses impressions



Traditional Process



3 to 5 Days



Digital Process



Scan Patient



Upload to Specialty's secure web portal



Specialty prints your models

ONE DAY



Intra-oral Scanners

- Scanners in the marketplace
- Influences on purchasing
- When do you purchase a scanner?
- Systems and formats



Accuracy of intra-oral scans



Sirona Cerac Where it all started



Ormco DPI 3-D intraoral scanner



Lythos compared to original Itero



DPI technology sold rights to Ormco

- Accordion Fringe Interferometry- extends 3-d scans in three dimensions
- 3-D scanning as easy as 2-D photography in the future
- Developed in MIT Lincoln Laboratory



3-M ESPE LAVA Scanner



Lava Scanner with cart has low profile wand

- Second oldest system around
- Multiple camera lens with blue light technology
- Cameras capture data and technology stitches the images together in real time
- Captures 20 3-D data points per second



3-Shape Trios Intraoral scanner



3-Shape Trios

- Spray-free for optimal accuracy and patient comfort
- Ultrafast Optical Sectioning™ technology for high speed
- Scanning with up to 1000 3D pictures for true geometries
- Easy to use with complete motion and positioning freedom
- Smart-Touch screen with live 3D visualization
- Less stressful impression-taking
- Wide range of dental indications
- Instant impression validation
- Online communication with the lab
- Reduced overall turn-around time



Planmeca Plan Scan Intra-oral Scanner

- Integrates directly with their software with cone beam and digital x-rays
- Total integration with planmeca software
- Scanner is manufactured by E4D
- Laptop or PC compatible



3-D Progress Intraoral scanner

- Portable: 700g
- Fast: Up to 21 scans per second, real time continuous single scans stitching
- Easy to Use: Feels natural in your hands
- Open System: STL output compatible with all CAD systems
- Direct in Mouth: No Powder needed! Go direct in mouth and take the impression!



Clon 3-D IODIS

System Features/Benefits:

- No Powder Required
- Fast and Efficient
- Open Architecture
- Supports Innovation
- Automatic Real Time Stitching
- Pause Scan with no Data loss
- STL File Output
- Supported by CAD Platforms
- USB 2.0 PC Connection
- Portable and Lightweight



Densys 3-D

The MIA3d solution features a system that is:

- A Stand-alone chair side unit
- Integrates easily with 3rd party CAD/CAM
- Small, quickly emailed Scan Output files
- Designed with Standards, readily available System parts/components



New 3M™ Scanner for around 16K

3M True Definition Scanner

The scanner features "3D-in-motion" video technology, which allows users to capture and simultaneously view a true replica of the oral anatomy, according to 3M.

The system will enter the U.S. market with a recommended retail price of \$11,995. Data plans begin at \$199 per month.



CEREC Omnicam: 3D scanning in full color





New Carestream intra-oral scanner.




Carestream Intra-Oral Scanner

- USB port hooks up to laptop computer – no heavy cart
- Full color scanning
- No Powder
- Real time scan viewing
- Low profile scanner head for both adult and pedo
- Lightweight for ease in use

Issues with Intra-Oral Scanners


- Technique sensitive
- Most units are on a cart to house the PC
- Data is incomplete
- Cost of integration
- Time of scan
- Limitations of use



Scanning Options:



There are three scan settings the clinician will choose from before the scan:

1. **iRecord** creates a "shell" model with no base. There is post processing that takes place to fill in any "holes" left in the scan if Auto Fill is checked.
2. **iCast** creates a based model ready for printing. There is post processing that takes place to fill in any "holes" left in the scan if Auto Fill is checked.
3. **Invisalign** creates a "shell" model that is not post processed, Leaving the scan with "holes".





"Holes"

- Holes are difficult to avoid during the scanning process and will be present in any scan.
- They can be caused by:
 - Small interproximal spaces
 - Black triangles
 - Shiny spots on the teeth
 - Clinician not capturing area in scan





Auto Fill


- Auto Fill is a feature that fills in any "holes" or information not captured during scan.
- Clinicians have the option to turn off Auto Fill before they begin a scan.
- Using Auto Fill becomes a problem for the lab only if the clinician has not included anatomy that is crucial to the appliance fabrication process.
- Unselecting Auto Fill will provide the lab with a scan that is not post processed, therefore leaving any holes that are present for lab to adjust for or reject scan





Scan with holes




Scan after Auto Fill






Scan after Export



After export, there is no color differentiation to alert lab technician to any inaccuracy due to Auto Fill





Invisalign Scan



The software alerts clinician to rescan areas not captured in scan when scanning under Invisalign

Invisalign Scan Viewed on Scanner

Although the software alerts the clinician to the holes, the software does not prevent them from exporting the scan.

Invisalign judges on a case by case basis if the scan is usable.

Invisalign Scan Exported

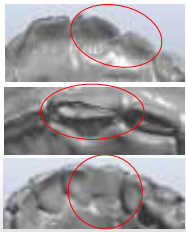
Once exported, an Invisalign scan will still have holes





Suspected Auto Fill





These are scans we have received and see features that we suspect are not accurate anatomy


Characterized by very smooth and flat surfaces, these areas are not always easy to spot






Itero introduced intraoral scanning to orthodontics




Limitations.

- Scanners have limitations.(Auto-fill, scan head size, processing time, scan time.
- This may contribute to the clinician leaving the scan with "holes" because they have run out of frames.
- There is an erase function that will allow the clinician to erase information that is not necessary to fabrication of the appliance and rescan information that is vital.
- Scanning of entire area needed is critical. Palate, buccal and lingual tissue.




Conclusion

- Scanners are not a guarantee for accuracy.
- The integrity of a scan is completely dependent on the quality of the scan process.
- Unselecting the Auto Fill option clues the technician into inaccuracies, however, the model will have to be adjusted to account for the "holes".
- Just like alginate impressions, if information is not captured, the model will not be true to patient anatomy and adjustments in model or appliance design will be needed.



Key points

- We have had several different impression materials over the years. There success depends on:
 - W-P ratios
 - Mixing time
 - Material handling
 - Technique
- With the new intra-oral scanners it is all about training and technique.
- Success is in the hands of the assistants
- Build a Quality System from the start



What do we do with this new data?

- Very exciting of the possibilities we now have available with this new technology.
- Immediate study models
- Better treatment?
- More informed treatment?
- Less training?
- Better tools to deliver treatment?
- More accurate form of impressions?




3-D Scanning

- We can improve our data and information with the new scanners.
- We can eliminate poor impressions with proper training.
- We can measure our results.
- We can determine band and crown fit digitally.
- We can remove brackets digitally.
- We can fabricate multiple appliances from a single scan
- What else can we do?



Leading Digital Intraoral Scanners

Column	iTero	3-Shape Trios	Cerac Sirona	Carestream 3500	3-M True Definition
*Price	\$22,500.00	\$40,000.00	\$40,000.00	\$22,500.00	\$15,999.00
Addition Charges	\$332/mo	\$400/mo	\$400/mo	\$450 annual	189 mo non align, 239 mo with align option
Scan Time	3-5 minutes	<3 min	<3 min	4-6 min	3-4 min
Powder	No	No	no	no	yes
Size/Portability	no	yes	no	yes	no
USB capable	No	Yes	no	yes	no
File Format	stl	vt	stl	vt	stl
Lab Communication	web upload	direct	web upload	direct	web upload
User Friendly	yes	yes	yes	yes	yes
Invisalign Certified	yes	no	yes	no	yes
Additional benefits	Proven	largest scan company	oldest scan company	technology company	affordable
Limitations	Scan head size	Scan head size	new to full arch	scan head size	accuracy



What are the costs?

- Scan fees-monthly maintenance
- Printing fee- \$9.50 per model if an appliance is made
- Multiple Scanners
- Training



Cost of Scanning

• Initial Cost- \$22,500 3 year amortization-per month	\$ 625
• Monthly Scanning fee	\$ 333
• Total	\$ 958
• Number of scans (Only)	12
• Cost per scan	\$ 80
• Fully Integrated scanning	520
• Cost per scan	\$ 1.85



Scanner Payback

• Records immediately-Eliminate digital model service		
• \$ 30.00 per patient x 200 starts (initial only)	\$ 30.00	\$6,000.00 yr.
• Eliminate separation appointment		\$ 75.00
• Retakes of impressions 4-6%		\$ 20.00
• Development and Stabilization		\$275.00
• Digitally remove brackets Deband to retention		\$250.00
• Guardian Retention Program-Eliminates Retainer checks		
• Total Savings per patient		\$650.00+



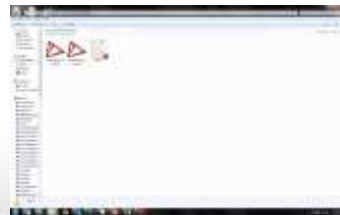
Uploading the digital files





Download the prescription sheets and save in a folder



Save you scan in same folder or if Itero it will upload automatically





Select files and place on portal


3-D Printing

- 3-D printers have allowed the realism of the digital technology impact our industry.
- We can now print what we see. (Scan)
- We can manufacture off the printed models.
- We can control undercuts and other variables before we print the models.
- Future appliances will be completely fabricated with 3-D technology


3-D Printing

- 3-D Printing is also know as additive manufacturing.
- Extremely accurate- down to 40 micron capabilities (Eden 260 V is 60 Micron).
- Started in aerospace and automotive industry.
- The next industrial revolution



New technology

Today's 3D printers can already create robots and artificial body parts layer by layer based on computer designs. But the U.S. government has much bigger plans for the futuristic technology — it wants to reshape American manufacturing by offering up to \$60 million for a new 3D printing institute.



Great uses in Medicine

Making Prosthetics



Studying Cancer





Printing Cartilage and bone, Printing Skin






Printing blood vessels and heart tissue as well as organs



Capable of printing items that function



Working Chain



Our 3-D printers



Models are arranged in software for print cycle



Model files can be stacked to make print jobs efficient. Shown are model files 2 rows high.



Orthodontic Uses:

- Printing allows an office to become an impression less office.
- Undercuts and model preparation is done digitally.
- Resets are scanned to make aligners.
- Multiple invisible retainers can be made from one scan.
- All orthodontic appliances can be made from printed models.

**Digital study models****Printed Models with Orthodontic Appliances****Bonded Retainers****Anterior Open Bite Retainers****Printed wax bite from a scanner**

RPE digitally expanded and then TPA made from the same file



Rapid Molar Distalizer. Make RMD and Nance from same scan.



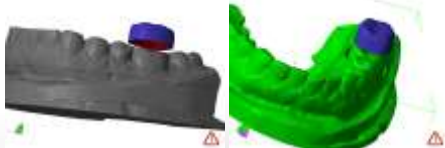
Digital set ups for case analysis



Ortho-analyzer software will measure IPR and areas needed



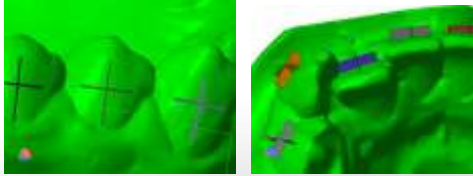
Some things we can do now with CAD/CAM
Band and Crown sizing



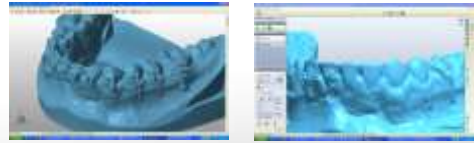
Crown fit with software



Indirect Bonding guides



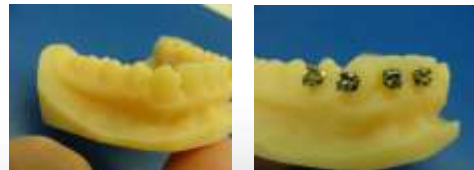
Brackets removed digitally



Brackets removed digitally



Long axis and heights printed on models for I.B.



New Indirect Bonding program



The exciting times of digital technology



Teeth are ideally set up for bracket placement



Brackets are placed on models



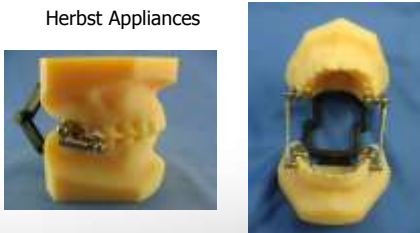
Models printed for Clear Image Aligners



Objet Eden 260V



Herbst Appliances



Invisible retainers and aligners



Printed models allow for multiple retainers to be made on them.



Specialty
Appliances

Indirect Bonding



Specialty
Appliances

Indirect Bonding with troughs printed to hold brackets in desired position. Exact Ortho.



Specialty
Appliances

Hawley Retainers



Specialty
Appliances

Bonded Retainers



Specialty
Appliances

Anterior Open Bite Retainers



Specialty
Appliances

Printed wax bite from a scanner



Digital articulation with printed post to represent vertical dimension.



Printed models and molding process.



Printable molds allow for accurate acrylic placement



Molds can be separated for easy removal



New software will allow us to design the appliance in the software and print or mill the appliances.

The technology exist now but the materials are not available at a reasonable cost.

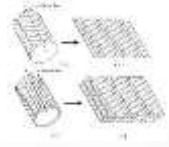


Digital design software has led to more accurate appliances.



Future of 3D Printing Materials

Graphene – Strong and light, almost transparent, conducts electricity and heat.



What are the cost?

- Scan fees
- Printing fee- \$8.50 per model if an appliance is made
- Multiple Scanners



What are the benefits?

- Eliminate shipping cost to the lab
- Less time to have appliances constructed
- Files can be retrieved for future use or reprinted
- Multiple appliances from one scan
- Digital records instantly
- Case presentation benefits
- High tech office



Other benefits

- Neat marketing to patients
- No impressions
- Very accurate if used correctly
- Immediate digital study models
- Virtual resets and diagnosis available
- Measurement of IPR
- Measurement of band and crown sizes



Limitations

- One scanner per office for 25K
- Must be on a roll around cart-attached to PC
- Technique sensitive
- Limited portability if you have multiple offices
- Scan fees
- 25 frames per arch
- Some scanners require powder coating



Other 3-D systems available

- 3-D X-Ray systems
- Cone Beam
- Cone beam can allow a digital model to be created from anatomage
- New software reduces radiation
- More precise diagnosis to all professions



New technology will change drastically over the next 5 years

- Eliminate Printing Models
- Manufacture orthodontic appliances directly on computer screen
- Printing of Metals such as Stainless Steel, Titanium, and many other alloys
- Dr. will have more control of appliance designs and precision of appliances.
- 3-D printing of brackets on a per patient basis



Impacts on our industry

Invisalign teen
 Six Month Smiles
 Cooperate centers
 Over 50% of all orthodontics now done by GP's
 Competition- Huge university programs
 Economy
 Technology



Six Month Smiles

- Started by Ryan Swain
- Taught by Six month braces Dr. Rick DePaul
- Treat social six for \$3,250 to \$3,500
- 12 dentist teaching other dentist around the world
- Over 3,800 dentist have received training
- Nearly every class is sold out
- \$550 for Indirect Bonding trays, composite brackets, wires, A-lastics, ligatures, IPR disc



Marketing

- Invisalign
- Six Month Smiles
- Cooperate centers
- Bracket companies
- AAO-New campaign



Compliance Issues

- HIPPA-New laws are in effect- No e-mail with patient names, photos, X-Rays, or other personal information
- OSHA-more agents than ever before- most likely not a great threat to an office
- FDA Regulations on laboratories- internal labs may fall under GMP guidelines
- All Laboratories are required to be FDA regulated with GMP policies



Discussion

- Questions?
- Comments?



Factors that are affecting our business

- Economy
- Regulations-HIPPA, OSHA, FDA
- Competition
- Invisalign
- Six Month smiles
- Internal issues
- Medical Excise Tax
- Technology



The Dental Lab Industry

- 10,482 Laboratories in the U.S.
- 7,482 Laboratories with Payrolls
- 3000 Laboratories with one technician
- 80% of all laboratories have fewer than 5 people
- \$632,000 average gross sales of each laboratory
- 43,600 number of technicians in 2009
- 33,000 number of technicians in 2012
- 6,000 number of C.D.T's and Recognized graduates

