ENHANCING DENTISTRY WITH TECHNOLOGY

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TECHNOLOGY HAS TRANSFORMED AND CONTINUES TO EVOLVE OUR PROFESSION
DISCLAIMER

- The speaker has no financial interest or professional affiliation with any products, companies, manufacturers or commercial entities
- Clinical associate professor, Stony Brook University, School of Dental Medicine
OBJECTIVES

• Identify and evaluate different technologies and technological advances
• Compare advances to traditional techniques
• Compare different types of technologies
• Evaluate accuracy, efficiency, and cost benefit
• Assess improved outcome of these technologies
• Discuss pros and cons
OBJECTIVES

• Identify technologies applied in different dental disciplines
  • Diagnosis and treatment planning
  • Implant surgery
  • Periodontics
  • Orthodontics
  • Oral surgery
  • Endodontics
  • Anesthesia/ monitoring
OBJECTIVES

• Recognize how these technologies elevate the standard of care and overall patient experience
• Discuss technological contributions to patient comfort and practice management
• Review ethical considerations
DIAGNOSIS AND TREATMENT PLANNING

- Digital Radiography
  - Intraoral sensors
  - CBCT
- Intraoral cameras
  - Caries detection
  - Transillumination
  - Perio mode
- Oral cancer screening
- Lasers
- Oral Scanners
  - Digital workflow
  - Prosthodontics
  - Orthodontics
  - Digital Smile Design
• Digital Radiography
  ▶ Fast, efficient
  ▶ Easy to transfer (insurance, other offices)
  ▶ Able to manipulate and enhance images
  ▶ Expensive to set up
  ▶ Annual service contract
  ▶ Biofriendly
  ▶ Low radiation (up to 90% less)

• Film
  ▶ Inexpensive
  ▶ Sensitivity (caries Dx)
  ▶ Comfortable
  ▶ Not biofriendly
  ▶ Difficult to transfer
  ▶ Time consuming and laborious
  ▶ Higher radiation

DIAGNOSIS AND TREATMENT PLANNING
DIAGNOSIS AND TREATMENT PLANNING

• Digital sensor
  ▶ Fastest image capture (less than 5 sec)
  ▶ Better image quality
  ▶ Expensive ($7-12 K)
  ▶ Annual service contract
  ▶ Sensor may be too bulky for certain pts

• Phosphor plates
  ▶ Plates are inexpensive
  ▶ Comfortable
  ▶ Less expensive to maintain annually
  ▶ Image capture can take a min or more
  ▶ Quality is not as good
  ▶ Time consuming and laborious
  ▶ Light sensitive

Different Sensor Systems

- Dexis
  - One size fits all
  - $11,995
- Schick (Sidexis)
  - Multiple sizes
  - $9,999
- Acteon
  - Multiple sizes
  - $7,000

Phosphor Plate Systems

- Air Techniques, Scan X
  - Multiple sizes
  - $8,000 - 15,000
  - Plates are about $30 each ($800 for cephal or PAN)
- Sidexis
  - Multiple sizes
  - $12,000 – 20,000
• CariVu
  ▶ Non ionizing radiation caries detection
  ▶ Acts like a transilluminator and an intraoral camera
  ▶ Can detect interproximal caries (posteriors better than anteriors)

  ▶ Cannot be used effectively if sealants or restorative materials are present
  ▶ Cost is $7,000

DIAGNOSIS AND TREATMENT PLANNING


DIAGNOSIS AND TREATMENT
PLANNING

- Diagnodent
  - Diagnostic laser fluorescence
  - Pit and fissure caries
  - Quantitative analysis

- Cannot be used effectively if sealants or restorative materials are present
- Cost is $3,000


• Sopro Life (care)
  ▶ Intraoral camera with occlusal caries detection and perio mode
  ▶ Great communication tool, co-Dx
  ▶ Building pt trust

  ▶ Cost
  ▶ Maintenance
  ▶ Issues with focus and image quality
  ▶ Cost is $4,000. Other brands are DigiDoc Iris $5,500, Air Techniques Cam X Elara $3,500

• Traditional methods
  ▶ Basic
  ▶ Inexpensive

  ▶ Patient mirror can be awkward
  ▶ Explorer limitations
  ▶ Pt skepticism

**DIAGNOSIS AND TREATMENT PLANNING**

Identafi enhanced oral cancer screening

- White, violet, green-amber light modes
- Dark = suspicious lesion requiring further investigation
- Increased vasculature = risk of becoming cancerous
- Code D0431

- Cost is $3,300. Needs Disposable mirrors and sheaths.
- Cannot easily capture image and document

CBCT 3D radiography

- 3D representation of structures
- Diagnostic for endo, OS, ortho
- Multiple renditions
- Capable of guided surgery

- Slower acquisition
- Cost

Panoramic X ray

- Great way to visualize multiple structures of Max/Mand
- Fast acquisition
- Cost effective

- 2D representation of 3D structures
- Distortion

Different CBCT systems

- Sirona Gallileos
  - Large Field of View (FOV) 15 x 15
  - SICAT Implant
  - SICAT Function (TMJ)
  - SICAT Air (Sleep apnea)
  - $170K

- Sirona 8 x 8
  - small FOV
  - $60K

DIAGNOSIS AND TREATMENT PLANNING
Different CBCT systems

- Sirona Gallileos
  - Large Field of View (FOV) 15 x 15
  - SICAT Implant
  - SICAT Function (TMJ)
  - SICAT Air (Sleep apnea)
  - $170K
- Sirona 8 x 8
  - small FOV
  - $60K
- Planmeca 11 x 8
  - Medium FOV
  - $71K
- Sirona SL
  - Mid- Large FOV 11 x 10
  - $117 K
- I Cat
  - Large FOV (15 x 15)
  - Used for implants, endo, TMJ, Sleep apnea
  - $140K
Putting it all together

- Co Diagnosis
- Radiographs
- Photos
- Scans
- Adjunct info

IF YOU CAN’T SEE IT, YOU CAN’T TREAT IT
Consultations

- Co Diagnosis
- Radiographs
- Photos
- Scans
- Adjunct info

IF YOU CAN’T SEE IT, YOU CAN’T TREAT IT
DIGITAL DENTISTRY
Scans and digital impressions
Lab scanning
- Pouring up model
- Inaccuracies or distortions are recorded in the scan

Stand alone scanner
- Send immediately to lab

CAD CAM
- Immediate fabrication in office
- Scan, design, mill
DIGITAL DENTISTRY APPLICATIONS

- Chairside restorations
- Laboratory fabricated restorations
- Implant planning and prosthetically driven guided surgery
- Invisalign
BENEFITS OF DIGITAL DENTISTRY

- Accuracy
  - Digital - 65.8 microns
  - Traditional - 98.9 microns
  - 3Shape - 7 microns
- Ease of use
- Efficiency
- Profitability
- Model free (cost, turn around time)

TRADITIONAL DENTISTRY ERRORS

- Elastomeric recovery
- Dimensional stability
- Distortion in storage of impression
- Expansion and contraction of gypsum
- Excessive die trimming
- Expansion and contraction of metal (for PFM s)
<table>
<thead>
<tr>
<th>System Name</th>
<th>Image Acquisition</th>
<th>Powder</th>
<th>Options</th>
<th>Open/Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M True Definition</td>
<td>Wavelength sampling tech (3D in Motion) and blue light LED video</td>
<td>Yes</td>
<td>Cart &amp; scanner, mobile unit</td>
<td>Open</td>
</tr>
<tr>
<td>3Shape TRIOS</td>
<td>Adaptive scanning technology with multiple cameras</td>
<td>No</td>
<td>Cart &amp; scanner; wand with pod and laptop, integration with dental unit</td>
<td>Open</td>
</tr>
<tr>
<td>CEREC BlueCam</td>
<td>Single images that are stitched together</td>
<td>Yes</td>
<td>Integrates with CEREC AC cart unit and CEREC AF desktop</td>
<td>Closed</td>
</tr>
<tr>
<td>Cerec OmniCam</td>
<td>Continuous color imaging</td>
<td>No</td>
<td>Integrates with CEREC AC cart unit and CEREC AF desktop</td>
<td>Closed</td>
</tr>
<tr>
<td>iTero</td>
<td>Parallel confocal scanning and continuous laser scanning</td>
<td>No</td>
<td>Cart unit or desktop version</td>
<td>Open</td>
</tr>
<tr>
<td>Planmeca PlanScan</td>
<td>Blue laser technology, continuous scanning</td>
<td>No</td>
<td>Scanner and laptop</td>
<td>Open</td>
</tr>
</tbody>
</table>
Different Systems

**CHAIRSIDE CAPABILITY**

- Cerec OmniCan
  - 30 yrs history and experience
  - Full system is $150K
  - Scan only is $30K

- Planmeca
  - Full system is $120K
  - Scan only is $38K

**SCAN ONLY**

- Trios
  - Arguably the fastest, most advanced
  - Cost is $45K

- True Definition 3M
  - Smallest intra oral wand
  - Touchscreen
  - Cost is $17K

- Itero
  - Color like scanning
  - Invisalign sponsored, chair side clincheck
  - Cost is $30K ($4400 annual support)

- Carestream
  - Continuous laser
  - Cost is $35K
Different Systems

CHAIRSIDE CAPABILITY

- **Cerec OmniCan**
  - 30 yrs history and experience
  - Natural color
  - Cart based system
  - Full system is $150K
  - Scan only is $30K

- **Planmeca**
  - Sophisticated software
  - Blue laser technology
  - Open STL save
  - 3 size tips
  - Full system is $120K
  - Scan only is $38K
Different Systems

SCAN ONLY

- Trios
  - Arguably the fastest, most accurate and most advanced
  - HD photo
  - True color
  - Cost is $45K

- True Definition 3M
  - Smallest intra oral wand
  - 3D in motion video
  - Black and white
  - Touchscreen
  - Cost is $17K
Different Systems

- **Itero**
  - Continuous laser
  - Color like scanning
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CHAIRSIDE CAD CAM

Restorations

- Inlays
- Onlays
- Veneers
- Crowns
- Bridges (up to 3 units)
- Surgical guides
CHAIRSIDE CAD CAM

Materials

- Resin
  - Provisionals
- Pressed ceramics
  - Can be simply polished
  - Can be stained and glazed
- Ceramic/resin hybrids
  - Polish only
- Lithium Disilicate (E.Max)
  - Crystallization required (20 min)
  - Stain and glaze
- Zirconia
  - Require special sintering furnace (40 mins)
  - Highest compressive strength
  - Recommended for molars
Chairside
- Profitability
- Time efficiency
- Less disposables
- No lab fee
- Quality control

- Stronger restorations require special furnaces
- Single appt but longer time slot
- Have to allot time for sintering, crystalizing

Lab Fabricated
- Restoration made by master ceramist
- Layered and Monolithic restorations
- Lab Discount, one way shipping
- No boxing, packaging, shipping errors
- Sophisticated multiple units and implants
  - Tooth borne
  - Implant borne

- Two appointments

DIGITAL SCANNING
SINGLE IMPLANT RESTORATIONS

Chair side or Lab fabricated

- Visit one
  - Scan treating arch
    - Interproximal contacts
    - Soft tissue emergence profile
  - Scan opposing arch
  - Buccal bite
  - Scan implant scan body
- Visit Two (Same day or in as little as 48hrs)
  - Insert prosthesis
Traditional Implant Impression

- Visit one
  - Multiple closed tray impression copings
  - Closed tray impression

- Lab visit one
  - Working cast
    - Implant analogs
    - Soft tissue model
  - Open tray impression copings
  - GC resin verification jig
  - Custom tray

- Visit two
  - Intra oral verification jig luted w/ GC resin
  - Custom tray open tray impression
Traditional Implant Impression

MULTIPLE IMPLANT IMPRESSION

- Lab visit two
  - Master cast
  - Bite registration rim
- Visit three
  - Bite registration, face bow
- Lab visit three
  - Mount
  - Fabricate prosthesis
- Visit Four
  - Try in
- Visit Five
  - Insert
MULTIPLE IMPLANT IMPRESSION

Implant Optical Impression

- Visit one
  - Scan treating arch
    - Interproximal contacts
    - Soft tissue emergence profile
  - Scan opposing arch
  - Buccal bite *
  - Scan implant scan bodies
- Visit Two (in as little as 48hrs)
  - Insert prosthesis

* For full arch cases, a provisional in two sections is ideal
  - Scan one side, then the other
Glitches

- THIS IS NOT A MAGIC WAND!!!
- Artifacts
- IT issues
- Scan won’t save
- Trouble advancing to next step

Clinical issues

- Limited pt opening
- Condensation
- Retraction
- Interproximal contact capture
- Light reflectance
TROUBLESHOOTING

Glitches

- Artifacts
  - Trim and rescan
  - Delete the current data set and rescan
  - Too much data?
- IT issues
  - WiFi connectivity
  - Internet access
- Scan won’t save
  - Corrupted file
  - Insufficient memory or storage
  - Delete some older cases or get more storage
- Trouble advancing to next step
  - Capture more data
TROUBLESHOOTING

Glitches

- Artifacts
  - Trim and rescan
  - Delete the current data set and rescan
  - Too much data?
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  - WiFi connectivity
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- Scan won’t save
  - Corrupted file
  - Insufficient memory or storage
  - Delete some older cases or get more storage
- Trouble advancing to next step
  - Capture more data
Clinical issues

- Limited pt opening
  - PVS quadrant tray
- Condensation
  - Turn on scanner ahead of time
  - Saliva ejector
- Retraction
  - Lips
  - Cheeks
  - Tongue

KEYS TO SUCCESSFUL SCANNING
Clinical issues

- Interproximal contact capture
- Orient scanner perpendicular and roll
- Light reflectance
- Shut off lights during scan

TROUBLESHOOTING

KEYS TO SUCCESSFUL SCANNING
Clinical issues

TROUBLESHOOTING

- Interproximal contact capture
  - Orient scanner perpendicular and roll
- Light reflectance
  - Shut off lights during scan

KEYS TO SUCCESSFUL SCANNING
If you can’t see it, you can’t scan it

- Subgingival margins
  - Scanning is passive
  - Elastomeric Impressions are displacive
    - Hydraulic and Hydrophobic
    - Force impression material in sulcus
    - Force fluids out of sulcus
      - GCF
      - Blood
      - Saliva
      - Water
      - Debris

- Pre op scan
  - To show lab previous contours
  - While waiting for anesthesia
    - Trim out area of interest
    - Time efficiency
Cost Analysis

Cost Savings
- “No” impression materials
  - Trays
  - Adhesive
  - Elastomeric materials
- Lab savings
  - Additional steps
  - Discount for scanned cases
  - One way shipping

Additional expenses
- Equipment loan
- Monthly and/ or annual expenses
- Inventory of material blocks
**Pros**

- Accurate
- Easy to use
- Fast acquisition
- Not technique sensitive
- Immediate evaluation of scan
- Ability to rescan chairside
- Quick turnaround time
- Versatile
  - Ability to do more
- Patient satisfaction
  - “WOW” factor

**Cons**

- Large start up cost
- Software upgrades
- Maintenance
- Size of camera wand
- Posterior areas are hard to get to
- Subgingival margins require gingivectomy

**BOTTOM LINE ON DIGITAL SCANNERS**
Simplifying Implant placement

- CBCT scan
- Intra oral scan
- Marry the two data sets
- Plan implant placement using software
- Mill guide
- Place implants

GUIDED SURGERY
Simplifying Implant placement

- CBCT scan
- Intra oral scan
- Marry the two data sets
- Plan implant placement using software
- Mill guide
- Place implants
Simplifying Implant placement

- CBCT scan
- Intra oral scan
- Marry the two data sets
- Plan implant placement using software
- Send out for guide
  - Or print guide

GUIDED SURGERY
ORTHODONTICS

Invisalign

- CEREC
  - Scan maxilla
  - Scan mandible
  - Buccal scan
- Rx online
- Clincheck in 24hrs
- 3D models

- iTerro
- Unofficial Clincheck in 20 mins
ORTHODONTICS

Invisalign scan
- Very accurate
- Excellent fit
- Best case scenario
  - 10 minutes to scan
- Worst case scenario
  - 45 minutes to scan
- Fast turnaround
- Staff can be trained to scan

Invisalign impression
- Accurate
- Good fit
- Best case scenario
  - 7 minutes to impress
- Worst case scenario
  - 14 minutes to impress
- 2 week turnaround
  - Shipping
  - Scanning at facility
- Staff can be trained to impress
CBCT

- Diagnosis
- Treatment plan
- Planned treatment
  - Sinus augmentation
  - Impacted 3\textsuperscript{rd} molars
  - Bone grafting
    - Ridge augmentation

ORAL SURGERY
CBCT and 3D printing

- Diagnosis
- Treatment plan
- Planned treatment
  - OMF reconstruction
Guided access
- CBCT and oral surface scan
- Merge data sets
- Mill guide
- Gain access to calcified canals

Guided surgical endodontics
- Conservative
- Precise
First Fit guided preparation dentistry

- Single appointment restorations
- No temporization required
- No major investment in equipment
- High patient satisfaction
  - Two visits
  - 2nd visit, anesthetize, seat
- Saves significant chair time

GUIDED PREPARATION DENTISTRY
The revolution?

- 8 X stronger
- Bio hygienic
- Monolithic, Milled
- More comfort due to accuracy
- Exceptional fit
- No shrinkage, virtually monomer free
- Fast turnaround (48 hrs)

DIGITAL DENTURES
The revolution?

Possibilities

- Impression is scanned
- Baseplate or try in is printed or milled
- No stone model
- Digital set up, design
- Back up - easy replacement

DIGITAL DENTURES
Records

- Good final impressions
- Midline
- Incisal edge location
  - Papilla meter
  - Alma gauge
  - Alameter
- Anterior tooth size
- Lip support
- Try in
- CR
- VDO
- Delivery

DIGITAL DENTURES
Key takeaways

- Eliminate errors in gypsum
- Eliminate expansion and contraction of PMMA
- Eliminate errors in investing and flaking
- Dense, strong dentures

Options

- Monochromatic teeth
- Polychromatic teeth
- Monolithic or bonded teeth
- Stippling
- Gingival characterization
LASERS

Soft tissue
- Diode
  - Frenectomy
  - Gingivectomy
  - Perio degranulation
  - Apthus ulcers
  - Herpetic lesions
  - Troughing
  - Biostimulation

- CO2
- NdYag
  - Perio
  - Biostimulation

Hard tissue
- Er Yag
  - Periodontal disease
  - Peri implantitis
  - Operative dentistry
  - Endo- PIPS
  - Osseous crown lengthening
**LASERS**

**Soft tissue indications**
- Frenectomies
- Gingivectomies
- Troughing
- Aphthus ulcers
- Periodontitis (degranulate and disinfect)
- Peri implantitis
- Bio stimulation

**Hard tissue**
- Operative
- Osseous crown lengthening
- Periodontal micro laser surgery
- Endo- PIPS
PATIENT COMFORT

High tech
- TV in front of operatory
  - Co Dx
- TV's on ceiling
  - Distraction
- Noise cancelling headphones

High touch
- Lavender cloths
- Tinted eye protection goggles
- Memory foam neck pillows
- Essential oil diffusers
Why use high tech when you can get the same result with low tech?

- CEREC vs composite
- Monitor fracture vs treat
- Laser vs SRP
- CBCT for all patients?
- Guided surgery for all patients?
ANESTHESIA

- Capnography
- BIS monitor
- Blue tooth pre cordial stethoscope
- videolaryngoscopy
What is in our future?

- 3D printing
- Removable