Technology: Integrating Clinical Technologies Into the Undergraduate Dental Curriculum

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CBCT, LASERS AND OTHER DIAGNOSTIC TECHNOLOGIES
Electromagnetic Spectrum

- **X-Rays**: 0.01 to 10 nm
- **Fluorescence**: 460 nm
- **Lasers**: 660 to 2940 nm
CBCT TECHNOLOGY
Cone Beam Computed Tomography

- CBCT or volumetric imaging technology allows large or small fields of view at short scan times and lower patient doses.
- Excellent modality for evaluation of oral-facial trauma, anomalies, and pathology.
- Useful for almost all dental disciplines
- A few dental schools are teaching CBCT scan acquisition to pre-doc students.

Since 2009 all major dental radiology texts have included CBCT as a separate chapter. It has become the most frequently requested advanced imaging modality when additional imaging is needed.
CBCT

- Anatomy – landmarks for CBCT interp, as well as adjunctive aid in verification of head & neck anatomy instruction.
- Pathology – 3D reconstruction of pathology enhances 2D views.
- Surgical planning – students need an appreciation for implant case prep.
- Forensic dentistry and bioanthropology – enhances forensics for students.
CBCT in the Curriculum

- At UTSD currently CBCT is part of a series of lectures on advanced imaging.
- In the D3 course CBCT will now have its own 2 hour time slot.
- D3 students on rotation through the radiology clinic will have an opportunity to participate in CBCT acquisition as well to review CBCT volumes for recognition of anatomy and pathology.
Currently all students get some experience in the restoration of implants.

Plan is for each student to participate in CBCT implant planning for a single implant placement and restoration.
Potential Financial Impact

- Obviously the biggest outlay is in the CBCT equipment. Most dental schools already have 1 or more units.
- A second major expense is implant fixtures, but many schools have established grants with implant vendors.
- A third expense equates to radiology faculty time and clinic coverage.
FLUORESCENT TECHNOLOGY
Use of Non-Ionizing Radiation

- The use of visible light of various wavelengths has been suggested as a diagnostic tool.
- Transillumination, laser fluorescence, and digital fiberoptic transillumination have been used for caries detection.
Light-emitting Oral Screening Tools

- Quantitative laser fluorescence (QLF) device using 655nm emitting light fluorescing tooth structure and subsequent measurement. DIAGNOdent®
- Transillumination through interproximal tooth structure and recording with CCD camera. DIFOTI®
- Fluorescent technology for cancer screening. OralID®
Cancer Screening Tool – Oral ID

- Fluorescence causes normal tissue to appear bright, but abnormal tissue is dark.
- Small, portable, no patient consumables, easy to use and affordable.
Cancer Screening Tool – Oral ID

- 63% of oral cancers are found in stage II and IV. At this stage less than 50% are survivable. Early detection = survivability.
Oral ID

- Currently there are 5 group practices each with an Oral ID device.
- Pilot study underway to test the usefulness of the device in the hands of dental students.
- Numbers of potential lesions will be recorded and the numbers of precancerous or cancerous lesions found will be reported.
Oral ID Future Directions

- If pilot study demonstrates a good efficacy as a screening tool additional Oral IDs will be purchased for routine use.
- Screening using the Oral ID takes about 2 minutes which should not be intrusive to incorporate in the patient comprehensive examination.
Potential Financial Impact

- An Oral ID device retails for around $1200. With approximately 45 students per practice, for efficiency, each practice may need 3 devices. Approximately $10,000.

- May need to provide additional training for faculty in the use of the device, but this would have potentially no impact.
LASER TECHNOLOGY
Laser Dentistry

- A wide variety of lasers are available for use in dentistry: Erbium, Nd:YAG, Diode, CO$_2$.
- Applications are many and varied: perio surgery, restorative, gingival troughing, biomodulation.
- Advantages: may not require anesthesia, minimal postoperative pain, precise.
- Disadvantages: cost, training.
Use of Laser Technology with Dental Students


- Applications that can easily be introduced: 1). Gingival troughing prior to impressions, 2). Simple restorative, 3). Biopsies, 4). Biostimulation/Biomodulation.
Introduction Into the Curriculum

- Summer elective course was introduced in the 2009 – 20 students.
- In 2013 laser curriculum was revamped and incorporated into the dental curriculum for D4 students.
- 6 hours of total lecture time, 2 hours online and 4 in the classroom.
- Preclinical – planned exercises using all lasers, 3 hours.
Introduction Into the Curriculum

Laser Curriculum Content

- History of lasers in dentistry
- Types of lasers used in dentistry
- Theories and properties of lasers
- Clinical applications and techniques
- Laser use safety
- Laser effects on tissues
- Patient management with laser use
Preclinical Laser Technique

- Preclinical student laser practice

Photo Courtesy of Dr. Juliana Barros and Dr. Shalizeh Patel
Clinical Care

Simple Restorative treatment

Photos Courtesy of Dr. Juliana Barros and Dr. Shalizeh Patel
Clinical Care

- Soft Tissue lesion management

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Photos Courtesy of Dr. Juliana Barros and Dr. Shalizeh Patel
Clinic Facility

- Laser Treatment Bays
Potential Financial Impact

- Costs of the laser equipment that can run from about $5,000 to as much as $35,000.
- Purchase of pig jaws and googles for the preclinical training.
- Modification of existing operatories by installation of curtains - $3200.