

2016 JCEG VIII Notes

February 17th

Ken Gladstone – Dolphin's airway analysis

- New way for minimum cross-section area. Instead of setting limits and drawing cross-sections, then draw points down the airway, then automatically picks out areas and color codes them. Showed how to show the sinuses.
- Can superimpose volumes, e.g. pre and post surgical advancement of jaws. Voxel based superimposition and regional voxel based superimposition. Do a rough superimposition by identifying points and then superimposing. Better yet do regional superimposition, get better superimposition by doing voxel based. If using different machines, voxel sizes don't have to be the same size to do this.
- Can save individual airway files as .stl files and then do superimposition. Will check with Swan about how to do more than two. To export .stl, go from photo display
- 2-sided sensitivity adjustment to identify areas in range between two houndsfield units.
- Can measure both volumes also as long as boundaries set same way.
- Ability to export T1 into same coordinates in T2?
- Color map of distance between stl and dicom
- Automatic algorithm to superimpose .stl to dicom
- Can export several (e.g. both dental arches and airway) in cone beam coordinate system into Meshlab, 3d party software.
- To do photo wrap with colors onto cone-beam – digitize four mid-sag points on face on both images.
- Can do overlay superimposition of 3d photo over conebeam. Do approximate, then do autosuperimpose.
- Showed how to do osteotomies.
- Since Dec 2014, splints can be exported in .stl format.
- Custom structures should be assigned to cranial base, maxilla, mandible areas so that they would transfer to superimpositions.
- 3D surgery software is available to school. Can compare predicted surface over actual post-tx surface.
- Will ask Swan about regional surface to surface or surface to volume superimposition

Jhimli Mitra, Case Center for Computerized Imaging and Personalized Diagnostics, School of Engineering

- Brain atlas
- Need method for automatic segmentation of regions or volumes without manual intervention.
- Need alignment (registration) of volumes or images of subjects into a common frame.
- Size doesn't matter, do scaling with rigid transformation so voxels map. For same patient longitudinally, do affine. Between people (average brain atlas to person) need to transform voxel size.
- Registration – affine -- adjusts for rotation, translation and scale – bony structures
- Deformable – adjusts for local deformation at pixel or voxel level o—soft tissue structures
- Use voxel wide method for registration and voxel-wide statistical analysis
- Brain tissue segmentation
- Estimate volume of white matter and gray matter and cerebrospinal fluid in a probabilistic tissue
- Skull-stripping on brain MRI, do deformable registration of atlas on the patient's face, apply transform and it's automatic.
- Cortical and subcortical parcellations, e.g. change in hippocampus volume.
- They're doing white-matter tract connectivity. They do deformation analysis for gliolastoma multiforme linking deformation to survival.
- Brain atlases are freely available with different kinds of parcellations. MNI152, AAL 116
- Do growing brains in separate atlases, not mixed with adults. Age specific atlases are available.
- Could do something similar for face atlases. Dolphin has tools for 2D averaging.

Dave Schecter (formlabs.com) - 3D Printer demo as google meeting

- Form 2 printer kit \$3500, 1 liter standard resin \$150
- Desktop SLA printer, stereolithography machine - Liquid resin in tray, hardened by laser, differs from fused deposition printers
- 100 microns, 50 microns, 25 microns – layer thickness
- Build platform 5.7 inches X 5.7 inches X 7 inches tall
- Finishing kit – was printout with isopropyl alcohol.
- All resins paintable
- Liquid resin stable 6 months, comes in three consistencies from tough to soft

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 - Motionview – Dan Knoch
- February 18th
 - Comparison of Dolphin and Slicer superimpositions
 - KAU - Ultrasound based jaw tracking
 - topsCephMate demo: Toni Magni
 - Dolphin: Ken Gladstone
 - Ortho2: Mark Hans
 - Digital study casts for customized appliances, Dominico Dalessandri, University of Brescia
- February 19
 - SUMMARY DAY

Motionview – Dan Knoch

- 3D printer
 - Indirect bonding software
 - Intraoral scanners all make bad data with holes. Takes too long.
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February 18th

Comparison of Dolphin and Slicer superimpositions

- Case thesis – Mohammed Bazina
- Slicer allows registration on irregular shape. Dolphin must use box.
- Results are very similar.
- Slicer method: Manual approximation first, segment cranial base, use Slicer to register on the cranial bases (takes about 15 files to do this). Runs on Macs.
- Dolphin – use landmarks for approximation with one in mandible to minimize rotation. Set boundary boxes. Then do voxel base superimposition. Dolphin now allows T2 to be exported with coordinates of T1. Then DICOM is segmented and compared in Slicer to allow the investigator to find differences in the Slicer and Dolphin skulls. Differences between registered T2s is about .25mm. To get numbers for statistics, picked 7 areas for measurements. Gonial angles have the biggest differences. Minimum area is nasion (part of cranial base registration).
- Conclusion: Dolphin is faster, easier, but needs color map and has purchase cost.
- Discussion: Non growing subjects. Choose cranial nerves ultimately, or maxilla or mandible.
- Slicer allows freeform registration area, Dolphin box may be inadequate for maxilla or mandible.
- Right now can save time doing registration in Dolphin and then export to Slicer for color map.
- Discussion: Is cranial base stable in transverse dimension? Off-midline fiducials?

KAU - Ultrasound based jaw tracking

- Fiducials in maxillary tray, open in hinge, protrusive, lateral, chewing
 - Segment the conebeam. Information is saved in ultrasound system and integrated.
 - Omniscan taken of dentition, make .stl casts
 - Showed examples of surgical patients.
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topsCephMate demo: Toni Magni

- Implement mean change expansion by Lysle Johnston? Rendering unto Caesar also.
- Incorporate as mean and minimum/maximum (what could happen and what is likely).

Dolphin: Ken Gladstone

- For conebeam derived lateral cephs, can use F8 to switch between renderings to help locate points.
- The voice is named "Margaret."

Ortho2: Mark Hans

- has Bolton standard overlay built in and it can be saved.
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- Discussion about advantages of 3D facial scanning
 - No radiation, multiple time points, superimposition, better details of treatment outcomes
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- Auto-superimposition of two images of same skull which has metal markers
 - Dolphin is 32 bit, limited to 2G memory.
 - 3D mandibular superimposition -- Do symphysis/pogonion voxel superimposition, click done, back to single image and put center of rotation at point on chin, rotate to third molars. Show both nerve canals in image. Do they save in vol/vol superimposition? Not yet.
 - Tried superimposition surface to volume of brain image to 17 year old patient.
 - Group will compile JCEG registry of existing CBCT images.
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Digital study casts for customized appliances, Dominico Dalessandri, University of Brescia

- Virtual set-ups using CBCT data
- Lit review JCO 2011 45:209-216
- Mimics & Dolphin versus 3Shape
- Keep roots in bone
- Intermediate steps difficult
- 3 Shape doesn't allow slices anymore, but can do all intermediate steps. Software instability, indirect DICOM control
- Manual segmentation required
- Dan Knoch does segmenting of scanned crowns and places in CBCT with template roots. Template roots are deformable to shape of natural root. (tracing in 3D) Intraoral scans accurate to 30-40 microns. CBCT only accurate to 300-400 microns.

February 19

SUMMARY DAY

- Next year – emerging technology. Dalessandri discusses [Smartphone-based orthodontic monitoring: the big brother in our patient's mouth](#), ideas he published in the AAO Tech Blog. Here is a local PDF version, in case the above link doesn't work: [Smartphone-based orthodontic monitoring: the big brother in our patient's mouth | AAO Tech Blog.pdf](#)
- Holography– Case has agreement with Microsoft
- Ken Glandstone says it is possible right now to trace incisors and molars as lines.
- Duterloo book on 2D cephalometrics/superimpositions
- Mark Hans will give Dolphin male and female Bolton templates to Dolphin and Tops. Case does not have the vector graphics – that was done by Ortho 2.
- JADA, Demster and Duddles, 1964 – average roots
- About the atlases – maybe import scans of same subjects dental cast rather than averaging teeth on CBCTs.
- Invisalign accepts Itero, 3m trudef (incognito) and Cerec (Sirona). Main Invisalign patent expires this year. Cerec Omnicam (Patterson) and Dolphin (Pattersono) are tightly integrated. It's color and powderless. Dolphin takes any .stl files.
- Face Scanning – captures different information compared to cone beams. Cannot replace. However, are useful because longitudinal studies can be done, i.e. Face Base. Would be especially useful for applications that need to assess soft tissue changes. Per Johan Wisth, University of Bergen
- Database of 3D CT images, create a registry of CBCT users
- Johnston forecast grid is useful and probably should be implemented in software.

File	Modified
PDF File Smartphone-based orthodontic monitoring: the big brother in our patient's mouth AAO Tech Blog.pdf	2016-03-22 by Toni Magni