Prospective Evaluation of an Online Atlas-Based Educational Intervention on Head and Neck Organ-At-Risk (OAR) and Lymph Node Level (LNL) Contouring: A Pilot Feasibility Study Using Web-Based Feedback and Analytic Software

Clifton D. Fuller, MD, PhD\textsuperscript{1,5}, Jayashree Kalpathy-Cramer, PhD\textsuperscript{2,5}, Jehee Choi, MD\textsuperscript{3}, Emma Ramahi, MD\textsuperscript{1,3}, Virginia Clyburn, MD\textsuperscript{3}, Abhilasha Patel, MD\textsuperscript{3}, Elizabeth Maani, MD\textsuperscript{3}, Anna Harris, MD\textsuperscript{3}, Daniel Baseman, MD\textsuperscript{1,4}, William E. Jones, III, MD\textsuperscript{3}, K. Kian Ang, MD, PhD\textsuperscript{1}, David I. Rosenthal, MD\textsuperscript{1}

\textsuperscript{1} University of Texas MD Anderson Cancer Center, Houston, TX, USA.
\textsuperscript{2} Massachusetts General Hospital, Boston, MA, USA.
\textsuperscript{3} University of Texas Health Science Center at San Antonio, San Antonio, TX, USA.
\textsuperscript{4} 21st Century Oncology, Asheville, NC, USA.
\textsuperscript{5} Dept. of Radiation Medicine, Knight Cancer Institute, Oregon Health & Science University, Portland, OR, USA.
Purpose

- Head & neck contouring of lymph node levels (LNLs) and organs-at-risk (OARs) is time consuming and operator dependent.
- We wanted to determine if an online atlas paired with real-time feedback designed to would reduce interobserver variation of head and neck (H&N) OAR and LNL regions-of-interest (ROIs) in resident trainees.
Study design

Contour Case 1
(26 ROIs*)

Educational Module:
1. RTOG H&N Atlas
2. Van De Water OAR atlas
3. Pacholke OAR atlas
4. In-House LNL atlas + TaCTICS software feedback

Contour Case 2
(referencing resources from educational module)

Analysis

*Residents contoured the bilateral level I-V and retropharyngeal LNLs, parotid, sublingual and submandibular glands, middle ear, vestibular apparatus, cochleas, upper and lower lips, and soft palate for each case
TaCTICS software

- Target Contour Testing/Instructional Computer Software (TaCTICS)
  - Gives near real-time semi-automated scoring (using Dice similarity index) and axial slice comparison of trainee ROIs with acceptable (“caution”) and unacceptable (“flag”) reference contours.

![TaCTICS screen-capture of user-generated left level IV LN ROI (red) comparison with “Reference Flag” ROI (green), exceeding “acceptable” anatomic contour range. Major deviation would result in credentialing “flag” (red).](image)
Results

• Interobserver differences decreased for 23/26 ROIs
• Interobserver differences decreased to statistically significant level (p<0.05) for bilateral LNLs I-IV, parotids, and submandibular glands.
• Educational module use standardized ROIs between users, so residents contoured more like one another.
• The effect was greatest for novice residents (incoming PGY1)
• 66% of residents reported software feedback as “helpful/extremely helpful”
• 100% deemed atlases “helpful/extremely helpful”.
• 100% reported they would like to use TaCTICS to track contouring skills over residency.

Average Dice similarity coefficient by year of residency training
Conclusions

- An atlas-based intervention combined with real-time software feedback was feasible and resulted in more uniform ROI contours.

- This suggests that online training modules might be constructed with TaCTICS to allow self-assessment of OAR/LNL/target delineation for resident trainees, and for cooperative group clinical trial credentialing.