Update on Task Group No. 253
Report on Surface Brachytherapy

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on behalf of the TG-253 authors

Disclosures
This presentation includes DRAFT societal guidance.

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Charges of TG-253

- Review approaches to surface brachytherapy, including:
  - Physical Characteristics
  - Safe use and handling
  - Dosimetric characteristics
- Develop a rational, risk-based set of QM procedures for the applicators and surface brachytherapy procedures, beyond that appropriate for general brachytherapy. These procedures will include (but not limited to):
  a. Definition of the physicists role
  b. Recommendations on acceptance and commissioning procedures
  c. Definition of a clinical QM procedure and frequency

Content summary

- Sources and systems included in the report:
  - Radionuclide-based systems (¹⁹²Ir, ⁶⁰Co)
    - Flaps and molds
    - Solid, conical surface applicators
  - Electronic brachytherapy systems (eBT)
    - Axxent (Xoft / iCAD)
    - INTRABEAM (Zeiss)
    - Esteya (Elekta)

Content summary

- TG-253 report organization
  - Description of sources and applicators
  - Review of peer-reviewed literature on dosimetric characteristics
  - Clinical considerations (workflow, planning and delivery considerations, radiation safety)
  - TG-100¹ based quality management
  - Example output verification worksheets
Content summary - eBT

- eBT systems included:
  Axxent, INTRABEAM, Esteya
- system geometry and energy vary, although all aim to treat non-melanoma skin cancers

System summary - Xoft

- Xoft Axxent system includes four cones:
  10 mm - 50 mm diam., SSD~21 mm (50 mm cone has SSD=30 mm)
- each cone has a flattening filter at the apex
- treatment times calculated by controller based on measurement of source strength in well chamber and output of each cone

System summary - INTRABEAM

- system first used for IORT applications
- two types of applicators to treat skin lesions:
  - Flat applicators:
    filter creates flat radiation field at 5-mm depth
  - Surface applicators:
    flat radiation field produced at skin surface
- 10 mm - 60 mm diam., SSD varies with cone size
System summary - Esteya

- Esteya system designed specifically for treating skin lesions
- 10 mm - 30 mm diam. cones
- Treatment times calculated by controller based on measured values for each cone
- Fixed SSD of 60 mm

Clinical notes

- eBT prescriptions for skin lesions:
  - ~6 Gy/fx for 42 Gy total at 3-mm depth
  - Lesions deeper than 5 mm and larger than 20 mm diam. are not typically suitable for eBT
- Treatment planning techniques vary:
  - From verification of times set by controller (hand-calculations) to more complex CT-based planning with heterogeneity corrections

Comments on published literature

- For systems included in TG-253:
  - Wide range of effective energies, geometry and dosimetry standards
  - $^{192}$Ir (~0.4 MeV) versus eBT (~0.03 MeV)
Comments on published literature
• wide ranging effective energies, geometry and dosimetry standards
  • Flaps/molds – thermoplastic materials and SSDs around 5 mm
  • Solid conical applicators – Tungsten alloys with source positioned parallel or perpendicular to treatment surface, SSDs ranging from ~10-60 mm

Comments on published literature
• wide ranging effective energies, geometry, and dosimetry standards
  • air-kerma based or absorbed dose to water based standards for traceable measurements
  • air-kerma: $N_k$
  • absorbed dose to water: $N_{Dw}$
  • variable user-access to calibration tools (ion chambers), limited data for appropriate chambers
  • TG-253 approval pending from ESTRO and AAPM

Consensus of TG-253 approach
• difficult to create uniform measurement guideline
• TG-253 resolution: provide recommendations of metrics and tools available for creating a QMP, with examples of output verification worksheets, process maps, and risk-analysis examples
• reduce overlap with existing societal guidance (ABS Skin Report, GEC-ESTRO Skin Report)$^2,3$


Example process map

- provide basis for developing a TG-100 risk-based QMP (which often includes QA tasks)

![Diagram of process map]

Example process map

- using example process maps, readers are guided to establish their own version and determine the failure modes at each step using the TG-100 methodology
- from the failure modes and assigned risk priority number, a comprehensive QMP specific to their institution is developed

![Diagram of process map]

Example output worksheet

- provides example of method for output verification, based on specific dosimetry standard and measurement tools
- user is expected to understand how example may need modification for use with their surface brachytherapy program

![Worksheet example]
Status of report

• current report under review with Therapy Physics Committee
• TG members met at AAPM18 to discuss organizational items
• next review cycle: Fall 2018
• future TG updates may consider role of 3D printing for surface applicators and newly available applicators

Thank you!
Questions?