Delivering a conformable dose distribution for advanced stages of cervical cancer using a hybrid gynecological applicator

Peter Morssink, Senior Marketing Manager Brachytherapy
How did we get to hybrid gyn applicators?

- Early LDR Gyn case with Radium in the 1920s
- First HDR in the 1980s
- First CT/MR applicator 1998
- Now MR based, fused with CT/PET volume implants
Embrace clinical data and resulting recommendations

Results of EMBRACE Study reflected in ICRU
- Established dose response curve
- Planning aim > 90 Gy
- Dose < 85 Gy results in sub-optimal local control

EMBRACE II
- Guide for the future of IGBAT

Tanderup et al. Radiother Oncol. 2016 Sep;120(3):441-446.

Disclaimer: Clinical evidence does not reflect Elekta products.
Venezia in clinical setting

Elekta Ir-192 User/Venezia\(^1\)

**Dose/Volume Response curve EMBRACE\(^2\)**

10 patients between FIGO IIB–FIGO IVB\(^1\)

Venezia consistently met ICRU guidelines across all stages

Potentially better clinical outcome

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How did we get to hybrid gyn applicators?

Transition from LDR to HDR

• Optimization of dwell times
• Shorter treatment times
How did we get to hybrid gyn applicators?

Transition from x-ray to MR

- Visualizing the applicator
- Visualizing the soft tissues and applicator
How did we get to hybrid gyn applicators?

Transition from point to volume optimization

• Adjust dose to tumor volume based upon soft tissue imaging
How the use of MR changed applicator design

Changes in materials—from metal to MR safe materials

- MR safe—PPSU materials
- Difference applicator strength
How the use of MR changed applicator design

Changes in materials—from metal to MR safe materials
- Different ways of fixating parts
- Requires physician training / different markers
- Designs evolved to more user-friendly designs
How the use of MR changed applicator design

Impact on treatment planning
• Image fusion—CT and MR
• Applicator modeling
The evolution of hybrid applicators

- From customer designed applicators to latest commercial design
The evolution of hybrid applicators

The Venezia™ applicator

- Two lunar-shaped ovoids that when clicked together form a ring
- Cervical stopper integrated
- One-click system for easy assembly
- Perineal templates for reaching vaginal extensions
- Ovoid holes allow parallel and oblique needles to reach the parametrium
- Cylinder caps allow treatment of the vaginal wall
The evolution of hybrid applicators

Expanding clinical capabilities

Reach the cervix, parametrium and vaginal extensions with one applicator

Deliver optimal dose to target, sparing OAR

Use for various patient groups (stage IB, IIA/B, IIIA/B and IVA)
Hybrid part of the applicator

With parallel needles

With parallel and oblique needles

Parallel, oblique and template needles
Hybrid part of the applicator

With parallel needles

With parallel and oblique needles

Parallel, oblique and template needles

Figure 4.11 Fit the Guiding Tube in the Interstitial Lunar Ovoid Tube
Hybrid part of the applicator

Guide tubes allow insertion of the needles with flexible titanium obturators
Hybrid part of the applicator

Precise depth of needles with insertion tool
Clinical examples of hybrid applicator cases
Clinical examples of hybrid applicator cases
What it means for Physics

Treatment Planning

Applicator Modeling and Implant in Oncentra® Brachy treatment planning allows for fast reconstruction of the applicator.

Standard length flexible needles can be reconstructed in different ways with the use of CT markers.
What it means for Physics

Treatment Planning

HIPO optimization

• Complex dose optimization in significantly reduced time

• Physics has more control on the parameters of the optimization

• Individual catheters can be locked during the optimization to maintain the dose in that area of the plan.
What it means for Physics

QA

• Regular pre-treatment QA
• Standard length needles and our absolute metric source positioning system reduce the physics workload and verification steps.
• Use the labels to identify the individual flexible needles
Conclusions

• The Embrace studies showed the need for a high dose (> 90 Gy)
• The Walter study\(^1\) showed that a combination of intracavitary and interstitial is the best combination to achieve the required dose
• The Advanced Gynecological Applicator provides this combined with the use in MR
• The placement of interstitial needles using guide tubes and the insertion tool reduces the complexity
• Applicator modeling and HIPO optimization reduce planning time needed

The AGA applicator Delivering a conformable dose distribution for advanced stages of cervical cancer

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Questions