

Automation of Eyeplaque Procedures

Q. DIOT, D. WESTERLY, M. MIFTEN

University of Colorado School of Medicine, Aurora, CO

INTRODUCTION

Integration of planning, delivery and recording of external beam treatments has been a major factor toward increased efficiency, flexibility and safety for clinics. In contrast, brachytherapy is often more labor intensive and still consists of a large number of manual steps, with very few integrated commercial solutions.

LDR eyeplaque procedures, in particular, involve a multitude of participants (Radiation Oncology, Eye surgeons, radioactive plaque supplier, and transport across the country) that makes departure from established workflows due to unforeseen circumstances unavoidable, increasing risk of errors and delays.

Our approach uses an interactive check list to automate the many tasks performed by other software. Our physics checklist currently has 29 items, not counting shipping and handling of radioactive packages.

AIM

Create an application to manage LDR Eyeplaque procedures in an efficient and robust way. Use VBA to call, automate and gather in a single place all the numerous tasks performed by other commercial applications. Simplify the process to improve handling of inevitable changes and safety.

METHODS

A new case starts by filling out the summary sheet. This Excel sheet contains most of the information to run all the planning tasks.

OR and Patient Survey and Release for I-125 Eye Plaque Procedures			
Patient Verification Prior to Treatment:		Confirmed in OR:	
Written Directive Signed:			
Patient Name:	Doe, Bob		
Patient MRN:	1234567		
Eye:	Right		
Plaque Size (mm):	16 mm, no notch		
Implant Date:	4/31/2020		
Estimated Implant Time:	9:00 AM		
Removal Date:	5/3/2020		
Estimated Removal Time:	9:00 AM		
Seed and Plan Information:			
Isotope:	I-125	Tumor GLD (mm):	11.0
Number of Seeds:	13	Tumor Apex (mm):	4.65
Mfr Activity Per Seed (mCi):	3	Rx Depth (mm):	5.0
Total Activity (mCi):	39.00	PO Number:	2022454
Manufacturer Date:	5/27/2020	Lot Number:	454

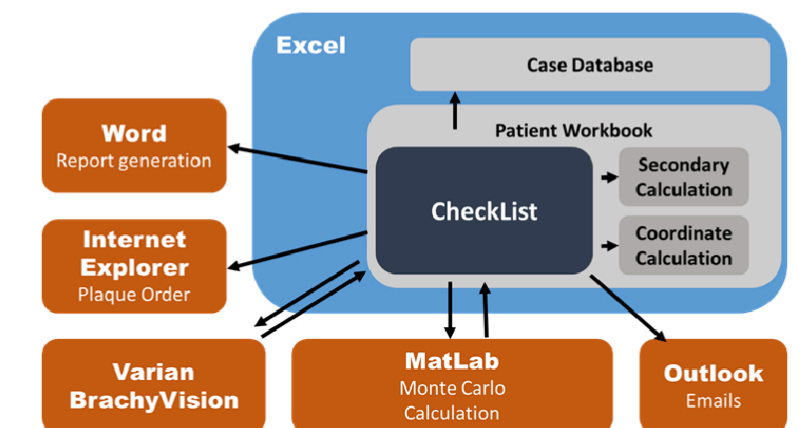
Another sheet contains a check list with interactive check boxes, many of which trigger macros that run Application Programming Interface (API) scripts. They automatically perform tasks such as

- Searching mailbox for patient information and generating email (surgeon, billing...)
- Creating a Varian BrachyVision plan and reporting calculation results
- Generating documentation for R&V systems
- Run secondary Monte-Carlo dose calculation
- Placing the order on vendor's website

6 Coordinate Calculation	1/27/2020
7 Use Secondary Check for activity Estimate	1/27/2020
8 Eclipse	1/27/2020
9 Report Dose in SpreadSheet	1/27/2020
10 Secondary Check	1/27/2020
11 Run Monte-Carlo Calculation	Calculated on 2/3/2020
12 Print Plan	
13 Check Plan	2/3/2020
14 Enter Rx in MOSAIQ	2/3/2020
15 Have Different Physicist Check Plan	2/3/2020
16 Show Plan to Oncologist, Approve in MOSAIQ	2/11/2020
17 Order Seeds	Ordered on 2/2/2020
18 Send estimate to Optalmologist	Sent on 2/14/2020
Seed Delivery:	
19 HallLab Log Book	2/11/2020
20 Wipe Test	2/11/2020
21 Seed Assay, Plaque Inspection	2/11/2020
22 Eye Patch	2/11/2020
Post-Implant:	
23 Billing (00029, 678031, 2032, 2893, 2902)	Sent on 2/11/2020
Post-Explant:	
24 Enter actual treatment time, PO number, Survey measurements	2/11/2020
25 Print Assay and Dose Calculation Sheet	Sent on 2/11/2020 To Vist
26 Fill out Special Physics Consult	Generated on 2/11/2020
27 Scan Paperwork and Import in Mosaiq, add weekly physics check tech info note	2/11/2020
28 Send actual dose estimate to Oliver	Sent on 2/11/2020
29 Add case to registry	Sent on 2/11/2020

All those steps are fully automated and only require to check the corresponding box. This gives us the flexibility of repeating any number of steps when necessary, as the planning process often gets revised due to scheduling issues. Most steps involved numbers that need to be reported accurately and in a standardized form, which automation performs much more successfully than rushed physicists.

The check list is very important as it permits the accurate tracking of the planning stages for each patient, so that any planner can pick up the work where another planner left it. This allows the handling of frequent interruptions of the workflow due to the wait for external participant's input or just staff coverage.



DETAILS

Many different interfaces are called from the Excel Worksheet using VBA scripts:

1. VBA generates summary dosimetry reports.
2. Connects to outlook to send email correspondence using the user account.
3. Call to MATLAB using the Excel MATLAB add-in. Uses a MATLAB script to get dose calculations using pre-calculated Monte-Carlo dose matrices
4. Connects to IExplorer and logs in to the vendor website, fills out the order form with plan parameters.
5. Connects to Word and uses a template to generate a formatted pdf report for R&V.
6. Starts an Eclipse API script to generate a new plan for the patient in Brachyvision, calculates the dose distribution, and send back the results to the worksheet without opening Brachyvision.
7. VBA keeps track of when check list items are completed or printed

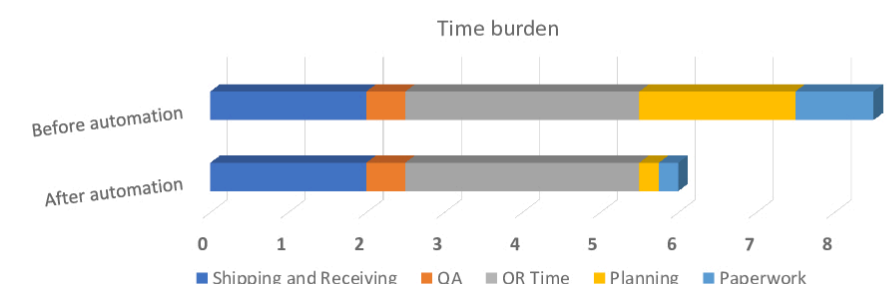
RESULTS

Our goal was to eliminate clinical but also reporting and paperwork errors, while allowing more flexibility to modify treatment plans as circumstances dictated.

Our checklist approach has been used with 150 patients and eliminated clinical errors.

Our automated checklist (90 patients) increased our efficiency and flexibility by reducing planning time/paperwork from 3h on average to less than 0.5h (30% time saving), with significantly less transcription errors.

About 20% of the cases need modifications due to scheduling changes or disease progression. Each replanning saves 2 additional hours thanks to automation.



CONCLUSIONS

Our approach relies on scripting the API of systems already in the clinic to achieve much greater integration when no alternatives exist. The use of an automated checklist for handling all aspects of eyeplaque treatments decreased all types of errors while increasing the workflow efficiency and our capacity to safely manage higher caseloads.

CONTACT INFORMATION

Quentin Diot, PhD DABR
Quentin.diot@cuanschutz.edu