Dose distribution transfer from CyberKnife to Varian treatment planning system

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Abstract. The aim of this paper was to introduce one of the options of the locally developed DDcon.exe which gives the possibility to transfer the dose distribution from CyberKnife (Accuray) treatment planning system (CK TPS) to Varian treatment planning system (Eclipse TPS, Varian). DICOM format is known as a universal format for medical data. The dose distribution is stored as RTdose file in DICOM format, so there should be a possibility to transfer it between different treatment planning systems. Trying to transfer RTdose file from CK TPS to Eclipse TPS the error message occurs. That's because the RTdose file in CK TPS is connected with Structure_Set_Sequence against Eclipse TPS where it's connected with RT_Plan_Sequence. To make it transferable RTdose file from CK TPS have to be 'disconnected' from Structure_Set_Sequence and 'connected' with RT_Plan_Sequence. This is possible thanks DDcon software which creates new RTdose file by changing proper DICOM tags in original RTdose file. New homemade software gives us an opportunity to transfer dose distribution from CyberKnife TPS to TPS Eclipse. This method opens new possibilities to combine or compare different treatment techniques in Varian TPS.

1. Introduction

Nowadays there are a lot of different treatment techniques such as TomoTherapy, CyberKnife, IMRT, VMAT, Brachytherapy etc., so it should be possible to compare or combine all these treatment techniques. To perform the action the dose distribution transfer from other treatment planning systems to Varian TPS Eclipse, might be available. The dose distribution is stored as RTdose file in DICOM format. It is known as an universal format for medical data for all treatment planning systems. Unfortunately it isn't. RTdose file transfer from TomoTherapy or Brahytherapy Masterplan to Varian TPS cause any problem, but it's impossible for CyberKnife RTdose file. To transfer dose distribution from CK TPS to Varian TPS the new option in DDcon software was designed.

2. Material and methods

Accuray - CyberKnife Treatment Planning System version MultiPlan 4.6.0 [2] and Varian Medical Systems: ARIA v.10 – Electronical Medical Records and Information, and Tretment Planning System – Eclipse v.10 was used.

RTdose is a DICOM file, where the calculated in TPS dose distribution is stored. Dose distributions may be represented as: 2D or 3D grids, isodose curves and named or unnamed dose points scattered throughout the volume. It may also contain dose-volume histogram data, single or multi-frame overlays, audio annotations, and application-defined lookup tables [1].

To go through with idea of transfer the dose distribution from CK TPS to Varian TPS a new option in DDcon software was made. It was written in Delphi programming language whereby it is fully transferable between different computers and any special instalation is required. To transfer RTdose file from CK TPS to Varian TPS the error message occurs. This is because the RTdose file in CK TPS is connected with *Structure_Set_Sequence* against Varian TPS with *RT_Plan_Sequence* connectivity. To make RTdose file transferable from CK TPS it must be 'disconnected' from *Structure_Set_Sequence* firstly and 'connected' with *RT_Plan_Sequence*. This is possible by DDcon software usage which creates new RTdose file by changing proper DICOM tags in original RTdose file (figure 1). All operations are based on our own algorithm of reading and converting DICOM files [2,3,4].

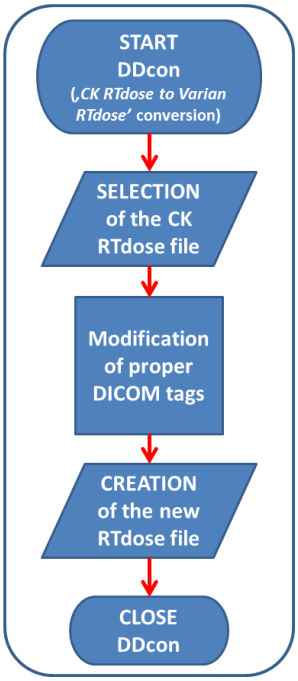

Figure 1. Flowchart of DDcon software showing how to change CK RTdose file to make it transferable to Varian TPS.

3. Results

To transfer RTdose file from CK TPS to Varian TPS firstly the CT scans and structure set from CK TPS have to be transferred to Varian TPS. Secondly treatment plan, based on the CT scans and structure set imported from CK TPS, with minimum one field and without performing the dose distribution calculations should be prepared in Eclipse TPS, Varian. After that it is possible to import

RTdose file, created by DDcon software, by connecting it with previously performed treatment plan. Figure 2 shows CT scans, structures, beams setup and dose distribution from CK TPS. Figure 3 shows imported CT scans with structure set and converted CK dose distribution in Varian TPS.

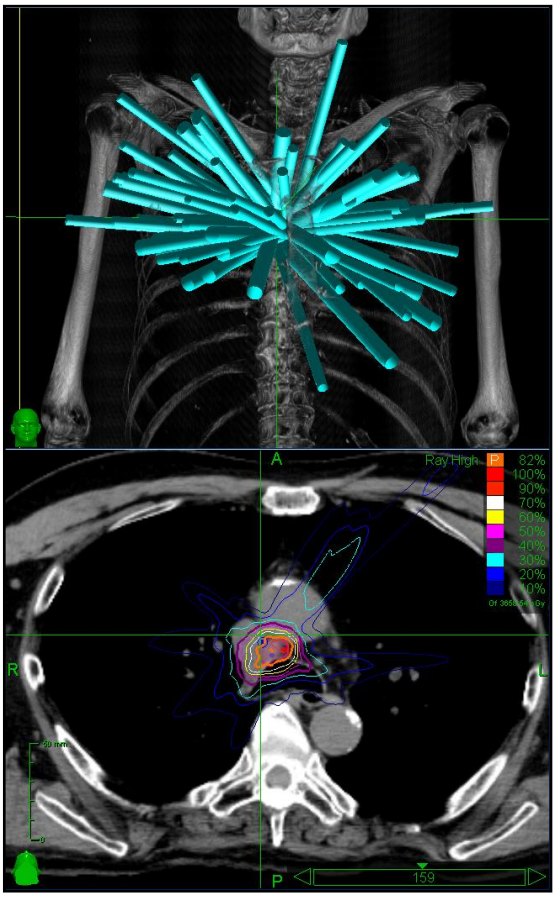

Figure 2. Printscreean from CK TPS showing beams setup and dose distribution which will be transferd to Varian TPS.

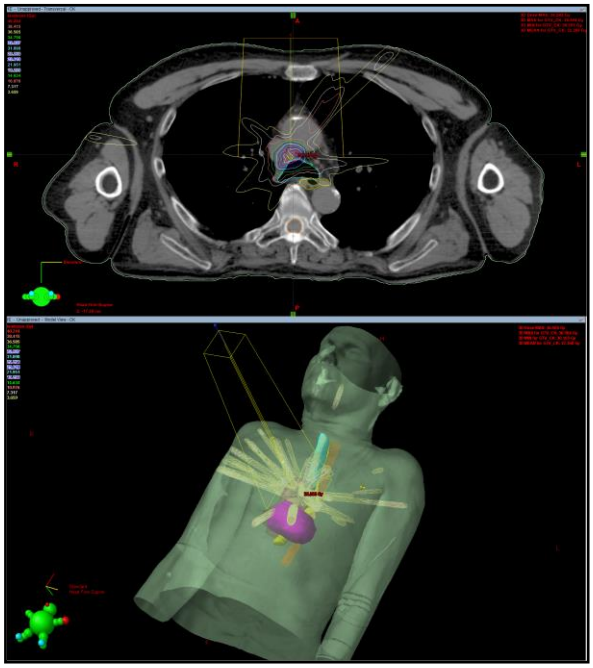

Figure 3. CK dose distribution transferred to Varian TPS.

4. Conclusion

The locally designed software gives the opportunity to transfer the dose distribution from CyberKnife TPS to Varian TPS. This method opens new possibilities to combine or compare different treatment techniques in Varian TPS.

References

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