Purpose/Objective: To compare TomoEDGE dynamic jaw treatments with traditional TomoTherapy for anal canal carcinomas.

Materials and Methods: A retrospective treatment planning study was performed on nine patients afflicted with anal canal carcinoma. All nine patients were treated in our clinic with traditional fixed jaw helical TomoTherapy using the 2.5cm field width (FW). The dose prescription consisted of two sequential series: 1) 36 Gy (1.8 Gy/fx) to the gross disease, parailiac, and inguinal nodes (PTVII) and 2) 23.4 Gy (1.8 Gy/fx) to the primary tumor (PTVI) for a total of 59.4 Gy. Each patient was replanned to the original prescription with the TomoEDGE dynamic jaws. Two plans were created for each patient, one using a FW of 2.5 cm and one using 5.0 cm. Dosimetric criteria was then compared on the dynamic plans with respect to the traditional TomoTherapy plan and with respect to published literature using conventional IMRT and RapidArc (Menkarios *et al* (2007), Clivio *et al* (2008), Vieillot *et al* (2010)).

Results: PTVI and PTVII coverage was excellent for both fixed jaw and dynamic jaw plans. The $V_{95\%}$ for both PTVs was greater than 99% in all plans and no plans had hotspots ($V_{107\%}$ > 1 cc) within the PTVI. Organ sparing was best for the TomoEDGE plan using a FW of 2.5 cm and was worst for the TomoEDGE plan using a FW of 5.0 cm (Table I). Average treatment times, for both series, were almost identical for the fixed jaw and dynamic jaw plans using a FW of 2.5 cm, however the dynamic jaw plans using a FW of 5.0 cm were approx. 40% less in treatment time. All three TomoTherapy plans showed significant improvements in organ sparing when compared to the published literature on conventional IMRT and RapidArc.

Table I. Dosimetric Criteria Comparison

	Static	Dynamic	
	2.5cm	2.5cm	5.0cm
PTVII			
$V_{95\%Dprescription}$ (%)	99.9	99.9	99.9
PTVI			
$V_{95\%Dprescription}$ (%)	99.6	99.6	99.5
$V_{107\%Dprescription}$ (cc)	0.0	0.0	0.0
D_{median} (Gy)	59.3	59.4	59.3
Intestine			
V_{15Gy} (%)	48.6	46.7	61.0
V_{30Gy} (%)	3.6	2.7	6.7
Bladder			
V_{15Gy} (%)	45.4	44.3	57.2
V_{30Gy} (%)	16.4	15.6	21.5
Femoral Heads			
V_{45Gy} (%)	3.0	2.9	3.7
D_{median} (Gy)	27.7	27.4	29.5

Conclusions: The TomoEDGE dynamic jaw treatment with the FW of 2.5 cm shows slightly better organ sparing than the fixed jaw treatment. This is likely a result of the decrease in irradiated tissue superiorly to the PTV due to the dynamic opening of the jaws. The 5.0 cm dynamic jaw plan showed slightly worse organ sparing than both 2.5 cm plans, however organ sparing was still much better than published dosimetric data for IMRT and RapidArc. The decrease in organ sparing is likely due to the lower number of rotations needed to cover the PTV with a 5.0 cm FW, which results in less modulation. The 5.0 cm dynamic jaw plan showed a large reduction in treatment time at the expense of slightly worse organ sparing.

EP-1582

Comparison of flattening filter applied and not applied IMRT plans in prostate cancer

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Purpose/Objective: Intensity Modulated Radiation Therapy (IMRT) makes sharp dose gradient around target, which is very useful to protect healthy tissues. Removing flattening filter (FF) from linear accelerator increase dose rate and change dose profile decreasing peripheral dose. Radiotherapy (RT) with Flattening filter free (FFF) beams could be beneficial for small target volume; because low peripheral dose will decrease doses around target and increase dose rate reduce treatment time. This study investigates the contribution of using FFF in IMRT plans.
Materials and Methods: Ten patients with prostate cancer receiving RT using IMRT were included. IMRT plans were generated for Truebeam STx lineer accelerator with and without FF using 10 MV. For all plans, dose calculations and optimizations were made using Eclips treatment planning system (Varian), AAA algorithm (version 11.0.31)and 400 MU/min dose rate. Field angles were fixed as 35^0, 80^0,110^0, 180^0, 250^0, 280^0 and 325^0. Target volumes were PTV1 (Prostate), PTV2 (Seminal Vesicle) and rectum and bladder were accepted as organ at risk (OAR). Total target volumes for PTV1 and PTV2 were 70,7-137, 4cm^3 and 114,9 cm^3- 189,3cm^3respectively. The prescription doses were 210cGy x 37 = 7770cGy for PTV1 and 180cGyx 37 = 6660cGy for PTV2. Dose constraints for OARs were: rectum receiving less than 7400cGy, rectum (minusPTV) volume receiving less than 7000cGy, 5% of rectum receiving ? 6500cGy, %40of rectum receiving ?5000cGy, bladder receiving less than 7400cGy, bladder (minus PTV) volume receiving less than 7000cGy, %40 of bladder receiving ?5000cGy. Dose distrubitions were compared as Maximum doses for targets and OARs and MU values. Furthermore dose homogeneity and conformality for PTV1 were examined.

Results: For all patients using FF and FFF plans achieved prescribed target doses and OARs dose limits. Dmax values were found significantly greater in FFF plans than FF plans (p=0.031 for PTV_1,p=0.00 for PTV_2); however, differences for both volumes were limited to 1%. Likewise maximum OAR doses were higher for FFF plans than FF; difference was 1% for rectum and 4.31% for bladder; difference was significant for rectum (p=0,009) while not significant for bladder. Homogeneity was better for FFF plans than FF; difference was 5% and not significant (p=0.815). Dose conformality was significantly more successful for FF plans then FFF (p=0.001), difference was 6.84%. MU values 20% higher for FFF in comparison to FF and significant (p=0.00).

Conclusions: According to results of this study FFF did not provide better OAR protection and less MU. This results are not compatible with other studies reporting better OAR protection in radiotherapy using FFF; mentioned studies used streotaxic RT technique, no information given about target volumes. One speculate that their targets volumes could be smaller than present study and large fraction size might be another reason.

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An analysis of the dose distribution in the SCOPE 1 oesophageal cancer trial data

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Purpose/Objective
Current research in oesophageal cancer radiotherapy is focused on improving outcomes by improving the quality of the radiotherapy, dose escalation, biological imaging and the use of novel concurrent systemic agents.This initial work has been undertaken to assess the impact of the planning algorithm used on the quality of the dose distribution with respect to the PTV in the radiotherapy plans of a national randomised trial.

Materials and Methods: The 95% isodose line ($V_{95\%}$ for 50Gy prescribed dose) for 176 patients from the SCOPE 1 trial (a National Cancer Research Institute (NCRI)and Cancer Research UK (CRUK) funded Phase II/III two arm trial of definitive chemoradiotherapy (dCRT) in oesophageal cancer) was calculated using a Matlab script based in CERR [1]. The treatment planning algorithms used in each plan were divided into Type A, where lateral electron transport is not modelled, and those where it is, Type B. The Jaccard Conformity Index (JCI) and Radiation Conformity Index (RCI) [2] between the $V_{95\%}$ and the PTV were then calculated for each plan and the relationship to the type of algorithm used tested using the Mann Whitney U test in the SPSS statistical analysis package (v20).

Results: The JCI (Median = 0.68, Interquartile range = 0.64-0.73) was shown to have a statistically significant dependency with whether the plan was calculated using a Type A (n=94, Median JCI = 0.67 Interquartile range =0.63-0.71) or Type B (n=82, Median JCI = 0.71 Interquartile range = 0.67-0.75) algorithm (Mann Whitney U test p<0.001). The RCI (Median = 0.70,Interquartile range = 0.65-0.76) was also shown to be significantly dependent on algorithm type (Type A: n=94, Median = 0.67, Interquartile range = 0.64-0.72, Type B: n=82, Median = 0.74, Interquartile Range = 0.70-0.83), (Mann Whitney U test p<0.001).

Conclusions: It has been shown using two conformity indices that the quality of the dose distribution between the 95% isodose line and the PTV is significantly correlated with the type of algorithm used. Furthermore, it has been shown that the conformity between the 95% isodose line and the PTV and hence dose distribution is significantly