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COMPARISON OF ENERGY DOSES 10 MV DISTRIBUTION USING PERCENTAGE DEPTH DOSE (PDD) METHOD ON LINAC: ELECTA AND SIEMENS

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Abstract. *The patient dosing on Linac (Electa and Siemens) can be determined by Source Surface Distance (SSD) technique using Precentage Depth Doses (PDD) method. The study was conducted by measuring PDD to compare the dosage distribution calculations on Linac Electa and Siemens device of photon energy at 10 MV. PDD is done with a 100 cm SSD technique at a depth of 0 to 25 cm. The dose distribution results between the Electrical and the Siemens PDD are almost the same in that the Dmax at 10 MV Siemens photon energy occurs at a depth of 20 mm while the 10 MV Electa photon energy occurs at a depth of 21 mm. Both Linac Electa and Siemens device this at the same energy of 10 MV there is a difference of 95.23%.*

Keywords: *Distrubusi dose, PDD, Photon Energy, Quality File Index*

I I NTRODUCTION

Dosismetry linac is a monthly calibration that aims to determine the quality, uniformity and symmetry of the file [1]. Uniformity of the beam affects the radiation dose received by the patient. The International Commission on Radiation Units and Measurements (ICRU) has recommended overall accuracy in delivery of ± 5% tumor doses. The American Association of Physicists in Medicine (AAPM) has been reported the overall uncertainty of the dose received at a particular reference point is about 5.6% [2]. The uniformity of the beam (flatness) is defined as a dose variation above 80% on a 10 x 10 cm^2 field area in the perpendicular plane of central axis. The uniformity of the tolerance file is ± 3% [3]. In using a dosimeter prototype the photon beam in the clinic must first consider the quality of the file [4]. For megavoltage the quality of the beam is determined by the concept of the penetration ability of the beam in water. By comparing the ability of different types of radiation energy to the pattern of the penetration of the beam in the water can be distinguished the quality value of each beam, the deeper the penetration of the beam in the water shows the higher the quality of the file [5]. There are two set-ups to determine the patient's dose measurements, the Source Surface Distance (SSD) technique using the Precentage Depth Dose (PDD) method and Source Axis Distance (SAD) technique with Tissue Phantom Ratio (TPR) [6]. PDD is a dose distribution located at the point on the main axis of the file within the fantom normally normalized to Dmax = 100% at the maximum dose of Dmax [7] with the Eqs. [1].

$$\text{PDD} = \frac{D_d}{D_{do}} \times 100\% \qquad [1]$$

Where Dd is dose at any point (%), Ddo is maximum dose (%). Analysis of the depth dose characteristics may help the selection of appropriate files for radiotherapy treatment when various energy beams are available. This is a dosimetric parameter to confirm the number of doses of measured values in increasing accuracy in radiotherapy treatment [8]. A modified formula for defining TPR from photon light but less effective in clinical applications [9] and small field ratios in the manufacture of TPR data for Electa Agility 6 MV photon light resulting in a similarity in the bulid up to a depth of 2 cm and a meeting point at a depth of 10 cm [10]. Previous research Ref [11] has reported that the measurement and analysis of the X-ray output

voltage at five hospitals in Medan City yielded values exceeding the 10% tolerance limit. Then Ref. [12] has measured and compared the PDD and TPR methods to determine the quality index of the beam on a 6 MV and 10 MV linec energy plane. The measurement of PDD method was performed on 100 cm SSD and TPR method on SAD 100 cm. The quality of the files can be quantized so that an index or constant of various measurable radiation energies and parameters is called the file quality index which can be determined from the PDD or TPR value [13]. Due to the accuracy of dosage TRS-398 (Technical Reports Series No.398) has provided practical guidance on the measurement of high energy photon radiation beam on medical accelerator to determine the file quality index using SSD technique with PDD method but theoretically using SAD technique with TPR method

II METHODOLOGY

In this research was conducted in Installation 2 of Medan City General Hospital. Materials and tools used in this study are Siemens M5782, Linac Electa Pricise 151614 and External Radiation dosimetry (Radiation Measurement Instruments). Measurement of field area is done on surface 10 x 10 cm with 100 cm SSD. Then do irradiation with a fixed SSD 100 cm by lowering the chamber from the surface with a depth of 0 to a depth of 25 cm. Afterwards, the measurements of 10 MV Siemens and Electa TPR were measured on 10 × 10 cm surface with 100 cm SSD, then the chamber value was lowered to a depth of 25 cm from the surface with 100 cm SAD, perform irradiation by lowering the water level in phantom from the depth of chamber 25 cm from surface to 0 cm with SAD remain 100 cm.

III RESULT AND DISCUSSION

PDD on Photon Energy 10 MV Siemens

The measurement result of PDD energy of 10 MV photon on Siemens M5782 based on Figure 1. The figure shows the depth distribution of dosage of PDD method on 10 MV Siemens photon energy. Distribution of dose build up area, Dmax at 10 MV Siemens photon energy occurs at a depth of 20 mm. Then the percentage of dose distribution will decrease gradually as the radiation on the medium will give its energy to the medium it passes.

PDD at 10 MV Electa Photon Energy

The measurement results of PDD energy of 10 MV photon on Linac Electa Pricise 151614 can be seen in Figure 2. The figure shows the depth distribution of dosage of PDD method on Electa 10 MV photon energy. Distribution of dose build up area, Dmax at 10 MV Electa photon energy occurs at a depth of 21 mm. Then the percentage of dose distribution will decrease gradually as the radiation on the medium will give its energy to the medium it passes.

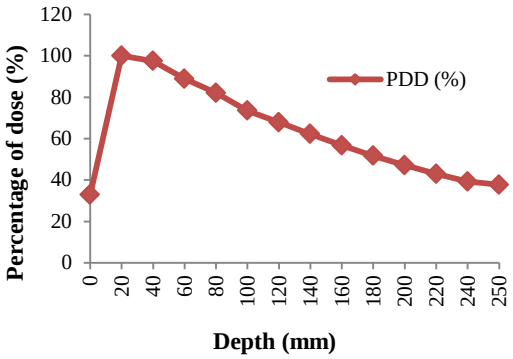

Figure 1 Graph of Siemens PDD at 10 MV photon energy

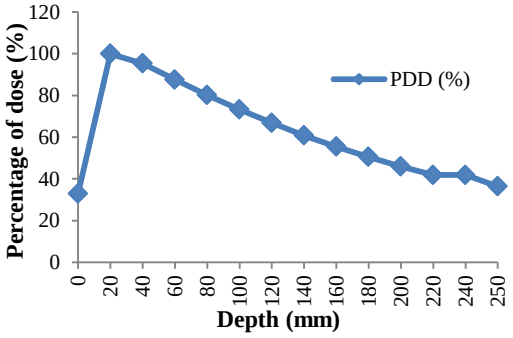

Figure 2 Graph of Electa PDD at 10 MV Photon Energy

PDD on Photon Energy 10 MV Electa and Siemens

The measurements of PDD energy of 10 MV photons on the Linac Siemens M5782 and Electa Pricise 151614 can be found in Figure 3, the following figure illustrates the depth distribution of the PDD dosage method on 10 MV Siemens and 10 MV Electa photon energies. In the build-up region the distribution of doses is almost identical in the line graph of almost coincidental until the maximum dose (dmax) is far apart. Basically the value of Dmax PDD is only used to know the dose to be received 100% at a certain depth [14]. Dmax at 10 MV Siemens photon energy occurs at a depth of 20 mm while at 10 MV Electa photon energy occurs at a depth of

21 mm. Ref [12] has reported that the measurement of the Elecata Pricise 5911 linac at one of the Bandung hospitals, 10 MV photon energy occurs at a depth of 2.4 cm or 24 mm [12]. These results are larger than Siemens and Electa aircraft in Medan. This is likely because the surface dose pattern is almost the same but after reaching dmax it will be different according to its energy. In measuring the energy of photons on the Linac plane there will be electron contamination because the photons that come from the electrons are pounded on the target targets and passed on the filter (flattening filter) [14]. Then the percentage of dose distribution will decrease gradually as the radiation on the medium will give its energy to the medium it passes. From both Linac and Siemens this at the same energy of 10 MV there is a difference of $(\frac{20}{21})$ x 100 % = 95.23%.

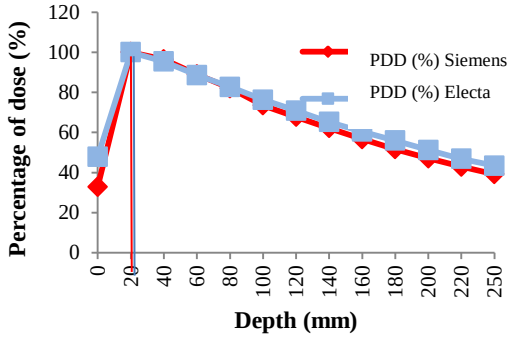

Figure 3 Graph of Siemens and Electa PDD at 10 MV Photon Energy

CONCLUSION

Distribution of doses between PDD Electa and Siemens is almost the same in that Dmax at 10 MV Siemens photon energy occurs at a depth of 20 mm while in Electa 10 MV photon energy occurs at a depth of 21 mm. From both Linac and Siemens aircraft this at the same energy of 10 MV there is a difference of 95.23%.

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