

Evaluation of basic characteristic of the TN-RD-50 system

Saburou Akiyama, Hiroyuki Nagashima, Yoshito Aikawa, Naoki Sano
Osamu Nakamura
Department of Radiology, Yamanashi Medical University

1, INTRODUCTION

Small detectors are necessary for skin dose measurement of local field in the radiotherapy and measurement of small radiation field like the radio- surgery.

Thermoluminescence dosimeters(TLD) has been used for these purposes.

However the use of TLD for clinical dose evaluation has several limitations.

The TN-RD-50 system uses MOSFET (Metal Oxide Silicon Semiconductor Field Effect Transistor) for the detector. This detector area is small about 0.04mm^2 and clinical usefulness of this detector to be similar to TLD.

The TN-RD-50 system can measured simply and real-time. This system has high sensitivity type and standard type .

This report compared basic characteristics in high energy region with high-sensitive type TN-RD-50 system and reference dosimeter(JARP type PTW-0.6cc probe) .

This time we examined energy dependence ,dose-rate dependence ,linearity and direction dependence.

2, METHOD

2-1 Energy dependence

It was exposure simultaneously with the reference dosimeter for each energy of $^{192}\text{Ir}(0.35\text{Mev})$, $^{137}\text{Cs}(0.662\text{Mev})$, $^{60}\text{Co}(1.25\text{Mev})$ and Linac(10MV X-ray) .

2-2 Dose-rate dependence

Using the Linac(10MV X-ray) ,the dose rate was made to change from 0.774mC/kg/min to 285mC/kg/min .

2-3 Linearity

We using the Linac(10MV X-ray). MOSFET was exposure simultaneously with the reference dosimeter .

2-4 Directional dependence

It was measured short axis plane and longitudinal plane with $^{60}\text{Co}(1.25\text{Mev})$.

3, RESULT AND DISCUSSION

3-1 Energy dependence

Results show in Table-1. The energy dependence became the good correlation for the reference dosimeter at ^{137}Cs (0.662MeV), ^{60}Co (1.25MeV) and Linac(10MV X-ray). However, the calibration of the sensitivity was required on ^{192}Ir (0.35MeV). Because of the ^{192}Ir has energy region of from 0.13 MeV to 1.06MeV , therefore it seemed to influence by low energy component .

Radiation Quality	Relative Sensitivity	Calibration Factor
10MV X-ray	0.99	1.01
^{60}Co γ -ray	1.01	0.99
^{137}Cs γ -ray	1.02	0.98
^{192}Ir γ -ray	1.33	0.75

Table 1. Energy dependence of the TN-RD-50 system for the reference dosimeter

3-2 Dose-rate dependence

Figure-1 shows the result of dose-rate dependence .

The dose rate could not be set from 0.774mC/kg/min to 258mC/kg/min,because it is limit of our liner accelerator.

In this renege ,it have a good correlation for the reference dosimeter.

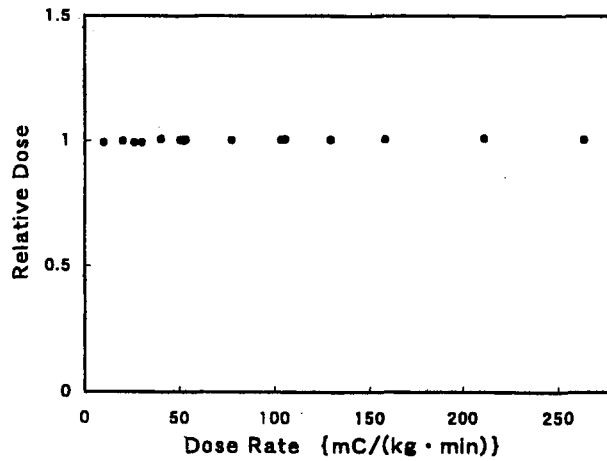


Figure-1 Dose-rate dependence with 10MV X-ray

3-3 Linearity

Figure-2 shows the linearity.

It was good straight line from 10cGy to 1200cGy.

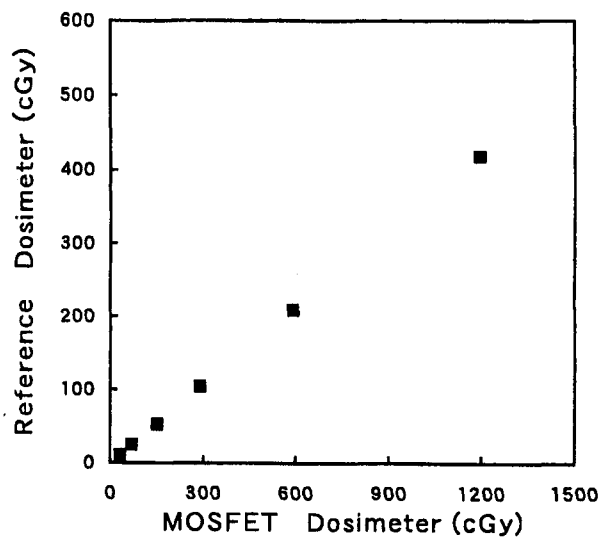


Figure-2 Linearity of MOSFET for the reference dosimeter

3-4 Directional dependence

The detecting profile of the MOSFET was the hemisphere . Therefore it has the directional dependence by this form, as shown in Figure 3.

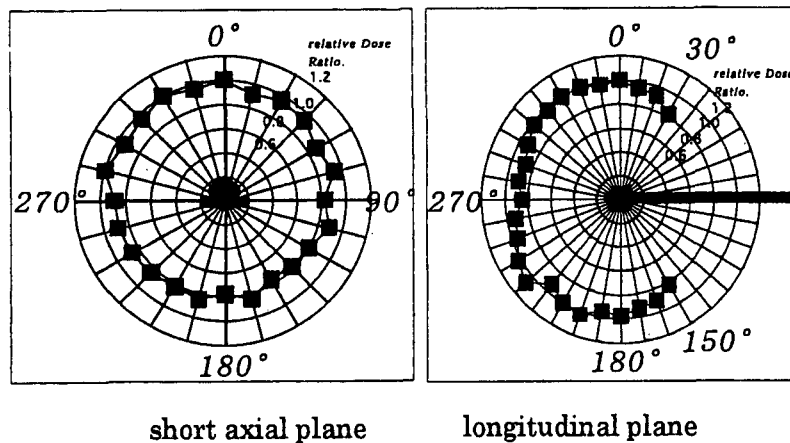


Figure 3 Directional dependence of MOSFET detector,
short axial plane and longitudinal plane.

4, CONCLUSION

The TN-RD-50 system is useful for the measurement of skin dose and small radiation field by basic characteristic and simple operability .It seems that there is the usefulness which can replace TLD in clinical use.

However , there is a limit at the measurement dosage (7Gy is a limit on the high sensitive type) and the limited detector can not be reused.

The MOSFET sensitivity was degradation about 10 months later from the manufacturing day , any attention is also necessary in order to use.