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THE DESIGN OF RADIOLOGY VIEWING BOX USING POTENTIOMETER SYSTEM

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ABSTRACT

Background: *In the process of work to gain the maximum results, a radiologist needs a viewing box tool to read radiographs.*
Aims: *to create a viewing box tool by using a potentiometer system.*
Methods: *This study used applied research method by creating and using the design of viewing box tool by using a potentiometer system and testing the viewing box tool created by using a Lux meter and 15 respondents consisting of five radiologists and 10 radiographers who should fulfill the questionnaire form.*
Results: *The mean of viewing box illumination reached 220 lux. The results of the questionnaire showed that 100% radiologist gave an A (excellent) and expressed that the viewing box tool created could be used properly and 90% radiographers provided an A (excellent) and expressed that the viewing box tool created could be used properly, while 10% radiographer gave a value of B (moderate).*
Conclusion: *viewing box tool created could be used properly and obtained optimal results as a tool in reading radiographs. Potentiometer system contained in the viewing box was very helpful in reading radiographs because it allowed to adjust the light intensity according to user needs.*

Keywords: *Viewing box, Potentiometer*

INTRODUCTION

In the work process of radiology installation, ionizing and non-ionizing radiation are using as energy sources. In the radiograph science, to obtain good quality and adequate radiographs, it is influenced by several factors, among others: the radiographic techniques, materials, equipment and techniques of darkroom/ processing. All of which is interrelated each other, so if one factor is ignored then the radiographic images produced will be inadequate. After passing through these stages then the operator will obtained a yield of radiographs, but radiographs are not the end of the radio-diagnostic examination process, without the written results or expertise from the radiologist then radiography process can be said to be redundant. In this case there is a need to implement quality control and quality assurance standards in viewing the radiographic images, to support the overall optimization of the radiography process [1]. Radiographer has a responsible to see the film to assess its suitability as a diagnostic support which is often referred to as the image quality [2]. Contrast, sharpness and the mean of density will be tested from each other and this is a quality that can be considered in accordance with the state of the displayed image. In general, the fewer the

number of odd light, the better the detection analysis of a radiologist to read radiographs, so it is advisable to reduce light scattering in the eye to enhance the performance capability of the radiologist [3]. The film with good quality is not necessarily better when viewed with the viewing box that does not meet the standards [4]. It's very important. Therefore, the selection of good quality viewing box is indispensable when planning the radiology department. There should be a comprehensive quality assurance program for the viewing box to obtain good, consistent and informative image visualization [5]. The display of light intensity of the viewing box should be able to set in low and higher lighting so that the detection accuracy when viewing calcification in the glandular tissue can be seen clearly [6].

Potentiometer is one type of resistor that the resistance value can be set according to the needs of electronic circuits or the needs of the user, it is often also used in the lamp brightness regulator circuit (Light Dimmer Circuit) and the voltage regulator in the power supply (DC Generator). Structurally, the potentiometer consists of 3 terminal feet with a shaft or lever that function as the regulator. Potentiometer as known as resistor with scroll connection which is made setting voltage divider [7].

Therefore, the authors want to develop a viewing box tool, which in general the work if this tool resembles the factory manufactured tool. However, the author would like to modify it into a viewing box tool with the light intensity that can be set by using a potentiometer as required in reading radiographs.

METHODS

This study used applied research method by creating and using the design of viewing box tool by using a potentiometer system and the function test was performed by observing the objects being created. In order to test the effectiveness of the modified viewing box tool, then the tool function test experiment would be conducted at the Laboratory of Mathematics and Natural Science, University of Udayana and in some hospitals during March 2009. The data collection process was carried out by tool test experiment to measure the color temperature of the x-ray viewing box by using Lux Meters and it was also tested in terms of effectiveness, both in function and other available supporting components in the viewing box [8].

The instrument used in this study was a questionnaire addressed to radiology doctors and radiographers. This questionnaire was used to obtain the data in order to test the function of the modified viewing box tool in accordance with the actual function. The points to be assessed include: feasibility of the viewing box tool to be used in accordance with its function, and the added benefits from the supporting components contained in the viewing box. Assessment indicator A meant good, B meant moderate and C meant less good.

In designing the viewing box the authors needed tools and materials used in its manufacture, namely: Electric drill, cable scissors, blade/cutter, mechanical pens, solder, tin solder, Acrylic (black and white with 2 mm thickness), power supply, sandpaper, power cable, black duct tape, LED (light Emitting Diode), glue gun, potentiometer, resistor (resistance), on-off switch, step-down transformer to lower the voltage of AC to DC voltage, dimmer light (inflows regulators), capacitors, diodes (1 Ampere), relay, head sink, fuse, PCB board.

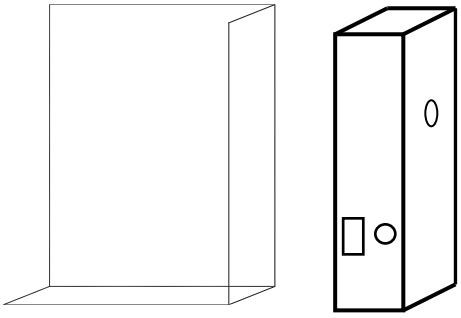

Figure 1 Acrylic pieces were adhered by using glue

As shown in figure 1. The process to make this tool was firstly by sketching on the surface of acrylic, in accordance with a box that will be created by using a mechanical pen, did the cutting and created holes for the placement of equipment/accessories required. Then the acrylics were arranged/shaped that have been cut by using glue, thereby there were formed two boxes with a height of 45 cm, length of 37 cm, a width of 7 cm and a height of 45 cm, a length of 8 cm, height 7 cm. The rear part of the viewing box was set to be opened and closed in order to facilitate the preparation of electronic series, LED lights and to simplify the tool repair at any time when the viewing box is damaged.

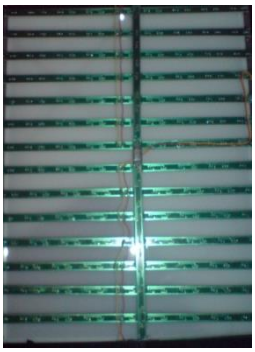

Figure 2 LED lamps series in the viewing box

As shown in figure 2. Firstly, potentiometer electronic system was outside the box before being placed in the box. This was done to facilitate the string. Then a series of LED lights that will be used on a viewing box were arranged with a distance of between 2 cm-3 cm for each LED (LEDs used here were as many as 288 pieces).

For each LED a resistance (resistor) of 220 ohm was provided in order to restrain the excess voltage that goes into the LEDs. After the series of LEDs and resistors was neatly arranged, then the series was attached in the box that has been made.

When all the components have been set and neatly arranged in a box, then all of the series were connected/linked to each other. The film prop was made on the front side of the viewing box by using rubber materials or similar material. The final stage was combining the box with bolts on the both boxes.

Figure 3 Modified viewing box by using potentiometer

RESULTS

The study was conducted from March to May 2009, to create a viewing tool box by using a potentiometer system. For viewing box lighting, the function test of the tool was conducted in the Optical Laboratory of Mathematics and Natural Science Faculty of Udayana University. Measurements were made by using Lux Meter and showed a mean of viewing box illumination of 220 lux. The function test of the viewing box was also conducted by using questionnaire addressed to 5 Radiology Specialists and 10 Radiographers in some hospitals to assess the feasibility of viewing box tool when it was used to read radiographs, and to assess the available supporting components on a viewing tool box.

Table 1 Frequency Distribution of the Radiologist and Radiografer in Assessing the Feasibility of Viewing Box Tools Use for Reading Radiographs

Variabel	**F**	**%**
Radiologist		
Good	5	100
Moderate	0	0
Less	0	0
Total	**5**	**100**
Radiografer		
Good	9	90
Moderate	1	10
Less	0	0
Total	**10**	**100**

As shown in table 1 , 5 radiologists (100%) who provided assessment, all of them provided Good on the Feasibility of Viewing Box Tools Use for Reading the Results of X-ray Photographs. 10 radiographers who provided assessment for the feasibility of viewing box use in reading radiographs, 9 radiographers (90%) provided an A (good) and 1 radiographer (10%) provided a value of B (moderate).

Table 2 Frequency Distribution of the Radiologist ang Radiografer in Assessing the Potentiometer System Contained in the Viewing Box

Variabel	**F**	**%**
Radiologist		
Good	5	100
Moderate	0	0
Less	0	0
Total	**5**	**100**

Radiografer		
Good	9	90
Moderate	1	10
Less	0	0
Total	**10**	**100**

As shown in table 2. 5 radiologists (100%) who provided assessment, allradiologistsprovided an A on the supporting components contained in the viewing box. 10 radiographers who provided assessment for the benefits of supporting components contained in the viewing box, 9 radiographers (90%) provided an A (good) and 1 radiographer (10%) provided a value of B (moderate).

The study results showed that the light intensity of the viewing box has met the standard of 220 lux. The whole radiologists who were respondents in this study provided excellent on the assessment of the feasibility of the viewing box in reading the radiographs and potentiometer system. Whereas most radiographers who were respondents in the study provided excellent on the feasibility of the viewing box in reading the radiographs and potentiometer system. The potentiometer system allowed radiologists and radiographers to set the required light intensity. Thus, viewing box can be used optimally in reading the radiographs.

DISCUSSION

Radiology viewing box is an assisting tool for radiologist in reading the radiographs. To be able to assess the radiographs, feasible viewing box tool is required. Most of the viewing boxes in Hospitals, especially in Indonesia have lighting system that can not be set. In fact, a good viewing box is a viewing box whter ich the light intensity can be set lower and higher to produce high detection accuracy to view calcification in the glandular tissue clearly [6]. Therefore, making a viewing box tool with the light intensity that can be set is an appropriate solution.

Potentiometer is a three-terminals resistor with a sliding connection which form a voltage divider that can be tuned [7]. By using the potentiometer system, then light intensity on a viewing box can be adjusted as needed. This viewing box used LED lights with evenly spread mounting in the box, so that the viewing box had an evenly spread light intensity.

The materials used in the manufacture of viewing box in this study used acrylic material, while most of the viewing boxes in hospitals use ferrous materials. The fundamental difference that made the viewing box in this study was that is was easily moved because the basic material was lighter. With the potentiometer system on the viewing box created it is expected to assist radiologists in reading radiographs with optimal results. In general, the fewer the number of foreign light, the better the detection analysis of a radiologist to read the radiographs, so it is advisable to reduce light scattering in the eye in enhancing the performance capability of the radiologist [3].

Limitation in this study was the size of the viewing box that was still reserved for 1 big film size reading, so it is not possible to compare the two readings on big size X-ray films.

CONCLUSION AND RECOMMENDATION

Based on the results obtained, in general the viewing box tool that was created could be used properly and obtained optimal results as a tool in reading radiographs. Potentiometer system contained in the viewing box is very helpful in reading radiographs because it allows to adjust the light intensity according to user needs.

The advantages of the viewing box made, among others; it can be made with materials that are easy to get, lighter because it is made of acrylic, light intensity can be adjusted by using a potentiometer.

It is suggested that the viewing box should be maintained every 3 months by cleaning it and checking the electrical equipment and the fluorescence lamps.

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