

EVALUATION OF A NEW TEST PATTERN FOR DAILY QUALITY ASSURANCE OF MEDICAL DISPLAY MONITORS

Hideki Fujita¹, Nao Kuwahata¹, Hidetoshi Yatake²,
Toshizo Katsuda³, Haruyuki Fukuda¹

¹*Saiseikai Nakatsu Hospital, Osaka, Japan*

²*Kaizuka City Hospital, Osaka, Japan*

³*Butsuryo College of Osaka, Osaka, Japan*

Introduction

In the visual evaluation of daily quality assurance (QA) of medical display monitors, some well-established test patterns are available.

However, the same pattern is always used.

It is difficult to detect luminance deterioration.

Purpose

We developed the new software for the daily QA of monitors (*mdQA*), in which randomized object (RO) patterns were generated.

We evaluated whether these *RO patterns* can detect luminance deterioration.

Materials and Methods

1. Development of the mdQA

☆ Programming language: Visual Basic 2010 Express

☆ Bit depth: 8-bit ☆ Matrix: 200 ~ 400 pixel

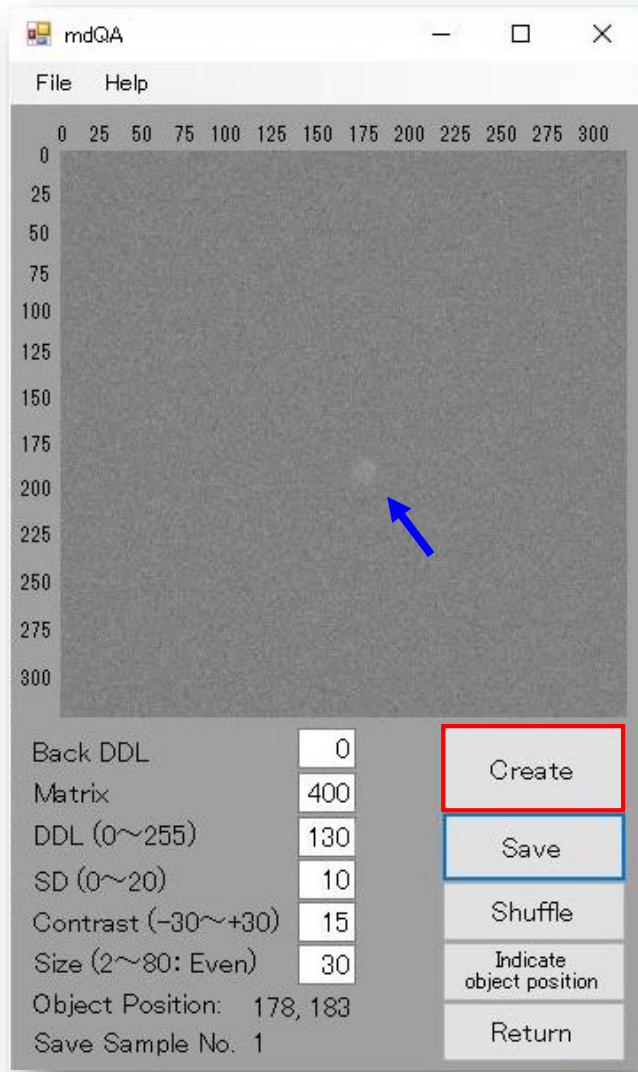
☆ DDL(Digital driving level) of the RO pattern: 0 ~ 255

☆ SD: 0 ~ 20 ☆ Contrast of the object: -10 ~ +10

☆ Size: 2 ~ 30 pixel ☆ Position: Random

EVALUATION OF A NEW TEST PATTERN FOR DAILY QUALITY ASSURANCE OF MEDICAL DISPLAY MONITORS

Hideki Fujita, Nao Kuwahata, Hidetoshi Yatake, Toshizo Katsuda, Haruyuki Fukuda, *Saiseikai Nakatsu Hospital, Japan*



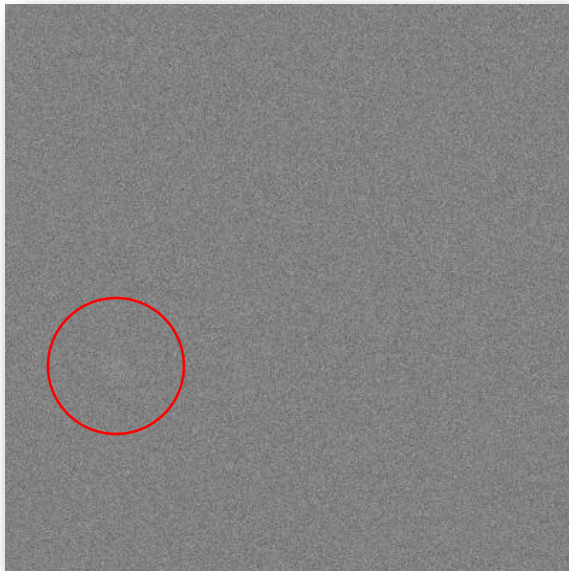
When the **Create** button is pressed, a RO pattern is produced. The RO patterns had a low-contrast object consisting of a randomly located sphere.

Appearance of the developed mdQA.

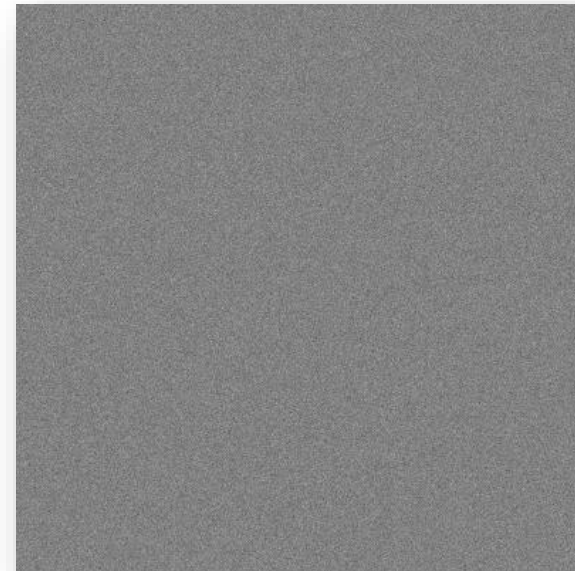
2. The parameters of the RO pattern

☆ DDL: 130 ☆ SD: 10 ☆ Matrix size: 400 pixel

☆ Object diameter: 30 pixels



20 patterns with a object
Contrast = 4 ~ 8



20 patterns without the object
Contrast = 0

Sample of the produced RO pattern.

3. Conditions of the observer study

- Monitor: 2-megapixel color LCD monitor (EIZO)
- Maximum luminance: **400 cd/m²** vs **320 cd/m²**
- Observer: Ten radiation technologists

4. Analysis of the observer performance

- ◆ Evaluation method: **ROC** (continuous-scale)
- ◆ Analysis: **AUC**, DBM-MRMC 2.5 (University of Iowa)

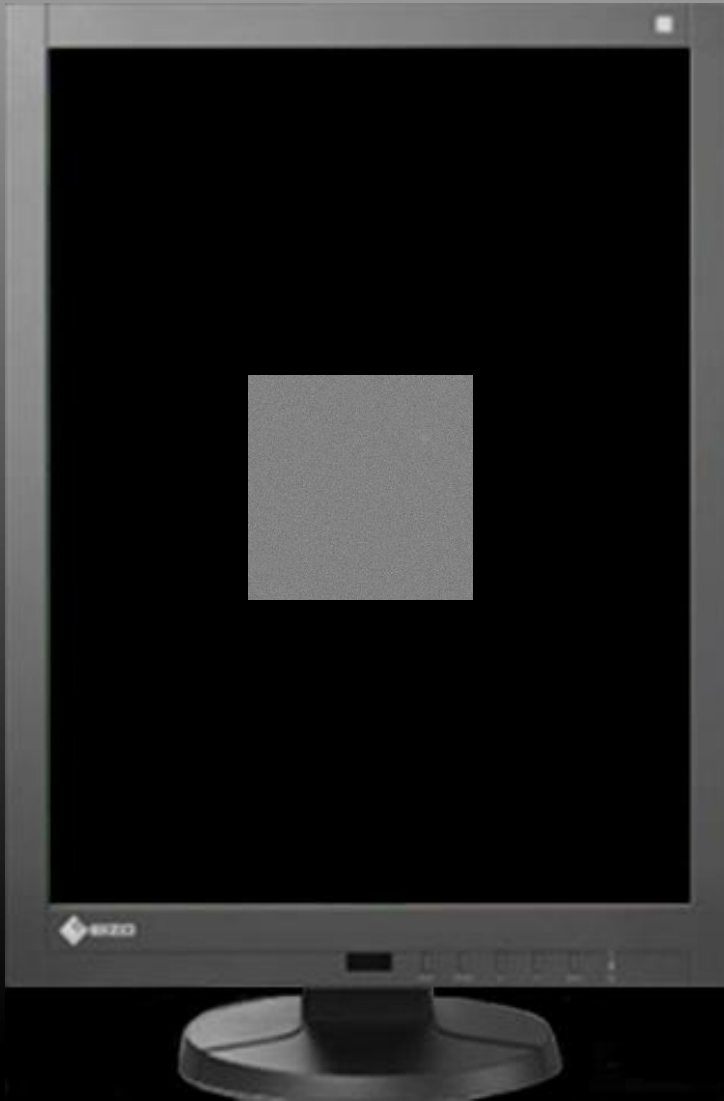
LCD: liquid crystal display

ROC: receiver operating Characteristic, AUC: area under the curve

DBM: Dorfman-Berbaum-Metz, MRMC: multi-reader multi-case

EVALUATION OF A NEW TEST PATTERN FOR DAILY QUALITY ASSURANCE OF MEDICAL DISPLAY MONITORS

Hideki Fujita, Nao Kuwahata, Hidetoshi Yatake, Toshizo Katsuda, Haruyuki Fukuda, *Saiseikai Nakatsu Hospital, Japan*



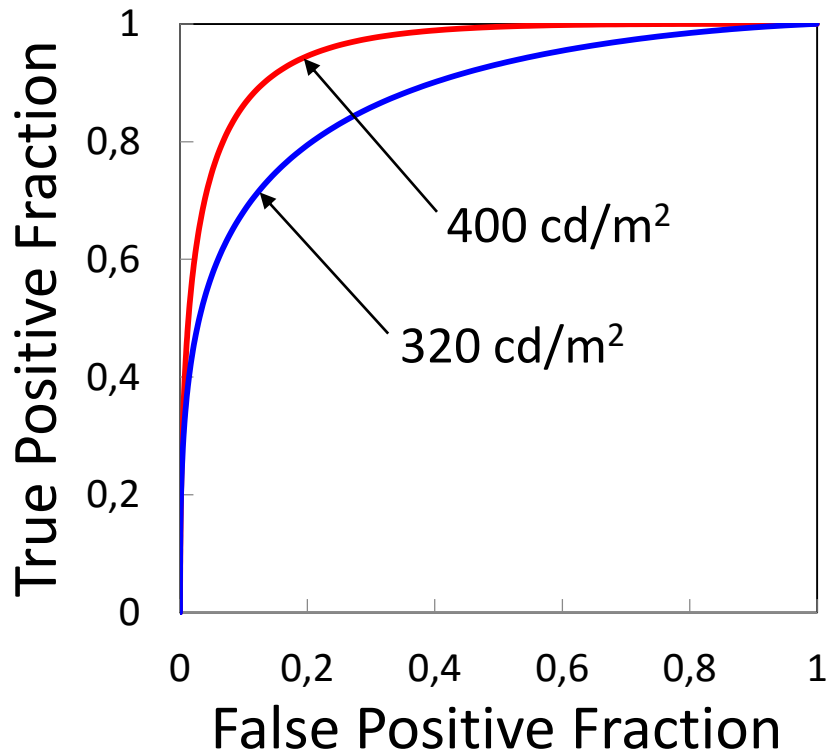
The distance and time of observation was unrestricted.

Ambient lighting conditions were adjusted to 65 lx.

The display function was set with the grayscale standard display function (GSDF).

Results

The average AUC for 400 and 320 cd/m² were 0.95 and 0.88, respectively. There was a statistically significant difference between the two LCD monitor conditions ($p < 0.01$).



Averaged ROC curves for ten observers obtained using LCD monitors of 400 and 320 cd/m².

Conclusion

The developed **mdQA** enables the creation of **RO patterns** for the daily QA of medical display monitors; these RO patterns are useful in detecting luminance deterioration.