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Development of devices for quality control to radiodiagnostic equipment utilizing 3D printer

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ABSTRACT

According to 2008 UNSCEAR [1] report, radiology is the biggest source of human exposure to ionizing radiation. For that reason, is essential to keep imaging equipment according to national and international standards, in order to avoid unnecessary exposure. In Brazil, current standard is Portaria 453/98 [2]. Unfortunately, the cost of quality test devices is high for many small clinics. With that in mind, we propose the development of a low-price device for the alignment, one of the quality tests.

Keywords: **Alignment test, cost, 3D printer.**

1. INTRODUCTION

The alignment test verifies that the X-ray central axis and the image receiving plane are properly aligned. According to Portaria 453/98, the difference should be no bigger than 3%, if that happens there will be distortions in the image. Usually, the devices used in this test are made of acrylic and fiberglass, these commercial devices can represent a big cost for small clinics, leading to negligence.

Our design consists in two 4 mm width planes with a small hole on the top. The distance between the holes is 15 cm, the same distance used by commercial devices. Two radiopaque material spheres should be placed in these holes. For our experiment we used 2 mm spheres, smaller spheres can also be used.

2. MATERIALS AND METHODS

The device 3D model was developed using the free ap TinkerCad, the whole model was made from zero. We used a Anet A8 DIY 3D Printer and a Lactic Polyaced based resin to print it. A small detail regarding the manufacturing process is that the 3D printer did not have enough resolution to print 2 mm holes, for thar reason we printer 4 mm spherical wholes.

We tested the device in a Computed Radiography equipment located in HC-UFG/Ebserh Hospital. The technique used (Figure 2) was 70 kV/20mAs during one second.

In order to analyze the alignment between the central axis and the receiving plane we need a guide table (the green table in Figure 1). Both spheres in the minor circle means that the equipment is properly aligned.

3. RESULTS AND DISCUSSION

The device and an alignment test image using it is showed below:

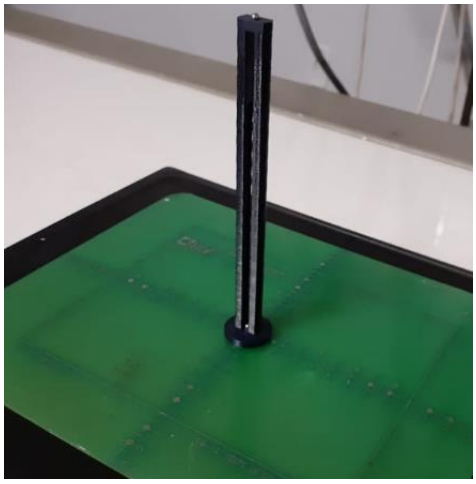

Figure 1: *Device with both spheres placed.*

Figure 2: *Alignment test image.*

As expected, the device provides an alignment test useful image, where both spheres are cleared showed. The device pillars presence in the image although unwanted, does not compromise the quality.

4. CONCLUSION

This article shows that a low-price device for alignment test that is operated at a routine radio diagnostic technique can be created using a 3D printer. It is important to stress that the device 3D model can be easily modified, thus it can be adapted for different equipment.

Unfortunately, this device cannot be used without a guide table. By itself, this table have the same cost problem discussed before. Because of that our next object for this project is to create a low-price table using circuit board materials.

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