ABSTRACT

Background: The aim of this study is to show the effect of improper patient head positioning on the distortion amount.

Material and method: Distortion amount is measured using a special ball phantom which contain 23 balls to check the patient positioning mechanisms using Planmeca 2002 CC Praline Digital X-ray unit by adjustment the position to 00 both x- and y- directions, then linear movement was done by displacement of the ball phantom +5mm anteriorly and-5mm posteriorly. Exposure to X-rays was done for each position. The three images were seen on computer screen, balls and space in between dimensions were measured using Dimax software.

Results: The results revealed that at zero position, balls appear round, all with same size, every spaced with constant magnification factors. When the ball phantom displaced, different distortion amount in the balls will take place especially in the anterior region.

Conclusion: Exact head positioning must be taken in consideration to ensure that wanted area is included within the zone of sharpness.

Key words: Radiography distortion digital panoramic.

INTRODUCTION

The diagnostic needs for dentomaxillofacial radiography have been increased dramatically due to the new treatment techniques and image criterion in dentistry. Until now, the patient’s radiography needs were transferred from one X-ray machine to another depending on the diagnostic requirements.

In recent years, the type of the panoramic machines offered to the dental profession, these machines image layer is based on scientific study of the human jaw’s shape and size. The size and shape of human jaws varies considerably depending on the patient size, race and sex. So the form of focal trough can be selected to correspond to the patient’s anatomy. The individual dentist must know exactly what layer of the patient his panoramic machines examines and must be interpreted differently because the path of effective rotation center, and the positions and shape of focal layers are different in each unit which has a critical influence in image quality.

In rotational panoramic radiography X-ray tubes to object distance and object-film distance control the degree of vertical magnification. However horizontal magnification has an important additional factor, namely, the speed of the film in relation to the speed of the X-ray beam at object point. Most manufacturers try to control the film speed to produce constant vertical and horizontal magnification over the whole film.

In addition, the patient head positioning is very important, because the selected plane or focal trough is three dimensional and lies in a curved vertical plane having a horizontal dimension designed to portray the object radiographically according to its position in the focal trough.

So any changes in the object position will affect its size and shape in the radiograph. This was demonstrated in AL-Sahher & Mohammed study (1994), they found a significant difference of radiographic dimensions exists between zero, anterior, and posterior skull positions using Orthopatomograph 10.

MATERIAL AND METHODS

Using Planmeca 2002 CC Praline Digital X-ray unit (60 KV and 20 mA), the position of lights was checked following the instruction in the technical manual.

1. The Frankfort plane light beam should be located between the two black lines on the alignment tool. It should be horizontal.
2. The plane in focus light beam should be positioned so that it is on the black reference line on the side of the ball phantom.
3. Midsagital light beam should take the black line on the front of the ball phantom.

Then the patient positioning mechanism was checked following the instruction of the technical manual by exposure of the ball phantom to check that rotational part, cassette carriage and the patient positioning mechanism is correctly positioned.

This checking was done first for calibration of the machine and second to take measurements at zero position. After that, second exposure was done with patient positioning mechanism in +5
forward positions. The third exposure was in -5 backward positions.

The three images were viewed on the screen of the computer. Using Dimax software on screen two click measurement system, giving the real diameter of the ball (6 mm) to the computer as information caliber the following measurements were done:

1. The distance from the center of the middle ball to the center of the rear middle ball at zero position.
2. The distance from the center of the middle ball to the center of the tenth ball to the left and right for the three positions for the three phantom positions.
3. The vertical and horizontal direction for the balls to the left and right for the three phantom positions.

RESULTS
At the zero position:
The images of 23 balls appeared round, all the same size, and evenly spaced.

The outermost balls on the left and right sides appeared symmetrical; the distance from the center of the middle ball to the center of the rear middle ball was less than 2mm. (figure 1)

The distance from the center of the middle ball to the center of the tenth ball to left and right was 120 mm (figure 2). The vertical and horizontal dimensions of balls were 6 mm (magnification factor of the machine is 1.2) (figure 3). The results indicate that the machine was well calibrated and balls in the phantom were within the zone of sharpness.

1. At +5 position:
The distance from the center of the middle ball to the center of the tenth ball on both right and left were 127 mm to the right and 128 mm to the left (figure 4).

The balls vertical and horizontal diameter dimensions also distorted especially in the anterior area with uneven spaces between balls. The balls had greater horizontal diameter and smaller vertical diameter dimensions. (figure 5)

2. At -5 position:
The distance from the center of the middle ball to the center of the tenth ball on both the right and left were 105 mm (figure 6). The balls vertical and horizontal diameters dimensions also distorted especially in the anterior area with uneven spaces between balls, the balls anteriorly were elongated with smaller sizes (figure 7).

DISCUSSION

The results at the zero position indicate that the machine was well calibrated and balls of the phantom where within the zone of sharpness, while at +5 position where the distance from positive center of middle ball to the center of the tenth ball on both the right and left were increased, in addition to the greater horizontal and smaller vertical diameter dimensions of unevenly spaced balls indicates that the positioning is too far backward and must be moved forward to the correct position. (4)

At -5 position, the distance between the center of middle ball to the center of the tenth ball on both right and left were decreased in addition to elongated smaller size of anterior unevenly spaced balls, indicates that the positioning mechanism is too far forward must be moved backwards. (4)

In this study, the distortion was seen only in the anterior area because the displacement was only anteroposterior, while if the displacement is laterally to the left or right, the measurements will vary between the two sides and adjustment in ball phantom’s Y-direction is mandatory. (4)

![Figure 1: Ball phantom at zero position (anterior area image).](image-url)
Figure 2: Ball phantom at zero position (total image).

Figure 3: Ball phantom at zero position showing the balls dimensions.

Figure 4: Ball phantom at +5 position (total image).
Figure 5: Ball phantom at +5 position showing the balls dimensions.

Figure 6: Ball phantom at -5 position (total image).

Figure 7: Ball phantom at -5 position showing the balls dimensions.

REFERENCES