
ASSESSMENT OF THE QUALITY OF LATERAL CEPHALOMETRIC RADIOGRAPHS OBTAINED IN A GENERAL RADIOLOGY APPARATUS

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ABSTRACT

The objective of this study was to evaluate the image quality of lateral cephalometric radiographs performed in an image accomplishing system with a general radiology apparatus and a cephalostat. Six examiners evaluated two distinct x-rays groups, being the first done by an adapted radiological system and the second by a control group with a conventional cephalometric apparatus. Each group was comprised of thirty exams randomly taken from the radiographic collection of the Dental Radiology Section at the Hospital for Rehabilitation of Craniofacial Anomalies, University of São Paulo. The radiographs were randomly numbered from one to sixty. The examiners established an orderly sequence of the exams according to individual criteria of image quality. The results were submitted to statistical analyses and according to Mann Whitney's test, there was a significant difference between the apparatus. From the methodology used and the results obtained, conclusion was

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reached that the radiographic system adapted by the HRAC to meet the patients' daily needs had higher image quality than those obtained with the conventional apparatus.

KEY WORDS: dental equipment; teleradiology; quality control; dental radiographic images

INTRODUCTION

Patients with cleft lip and palate at the Hospital de Reabilitação de Anomalias Craniofaciais da Universidade de São Paulo (HRAC/USP) were submitted to extra-buccal dental radiologic examination. One of the most used techniques is the profile cephalometry, also known as teleradiography in lateral norm.

Cephalometric radiography is the measurement of the linear and angular values in the head radiography. The name *cephalometry* is adequate, since “cephalo” means head, including bone, teeth and soft tissue; it differs from craniometry, which is restricted to measuring bone and teeth directly in the skull. The radiography has the advantage of projecting all the morphology of the head in a sole plane, making the measurement easier (PEREIRA et al., 1998).

The profile cephalometric teleradiography is used in orthodontics and pedodontics to evaluate skull growth (ALVARES; TAVANO, 1998). This technique is also used by buccomaxillofacial surgeons to define a treatment plan for orthognatic surgery. In this type of radiography a device is used to hold the head in position, called cephalostat. This device allows the positioning and repositioning of the patient's head in a predetermined relation in what concerns the X-ray flux and the horizontal plan of Frankfurt, which is a virtual line going through the upper rim of the cephalostat olive (porium) and the lower orbital rim (orbital point). The lateral norm or profile is the most used cephalometric radiography. In this case the left side of the patient should be closer to the film plate. In cephalometry the distance accepted for the focal point of the Z-ray equipment and the patient is 1.52m. The localization point in the patient is measured from the median sagital plan, which is taken as the mean point between the olives of the cephalostat. This device immobilizes the head of the patient by means of a positioning shaft at the nasium and by the auricular olives. The head of the patient is aligned according to the plan of Frankfurt by an infra-orbital marker. The median sagital plane should be parallel to the film and perpendicular to the ground. The cephalometric lateral radiography is

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used to measure the facial relations and to make a prognosis or to analyze the growth pattern in orthodontic treatment. This is made by cephalometric design (cranial) of key structures, evaluated by measurements of angles and linear dimensions between various parts (LANGLAND; LANGLAIS, 2002).

In 1989, due to the high number of exams performed – circa 10.000/year – the Sector of Radiology proposed new system for obtaining such radiographies. The maintenance sector of the HRAC, with assistance from Dr. Luiz Casati Alvares from the Dentistry School of Bauru (FOB-USP), was in charge of the construction of the equipment according to the specifications in the literature (SILVA FILHO et al., 1984). The system includes a 100 mA and 90 kVp Roentax 100 tube (EMIC, São Paulo) mounted in a wood platform lined with formic, attached to light systems of bundle direction (FIGURES 1 and 2). A cephalostat was fixed on the wall against which the patient was positioned, remaining seated in a height regulated chair (FIGURE 3). The distance from the focal point of the equipment to the mean sagittal plan in the patient is kept according to the previously mentioned reference. The overall investment, including mounting and installation, resulted in an excellent cost-benefit relation to the institution.



FIGURE 1 – The adapted radiologic system with a 100 mA, 90 KVp Roentax 100 tube (Emic, São Paulo) assembled in a wood base covered with formica connected to a light system of bundle direction.



FIGURE 2 – The same as in figure 1 in a close up view.



FIGURE 3 – Height regulated chair and the cephalostate.

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MATERIALS AND METHODS

Sixty lateral telerradiographs were divided in two groups. The first groups included those radiographs taken with the equipment that was adapted in the HCRA and the second group included the radiographs taken with a standard Rotograph Plus (Villa Sistemi Medicali, Itália) equipment (FIGURE 4). Each group had 30 radiographs taken at random from the archives of the Sector of Dental Radiology of the HRCF-USP.

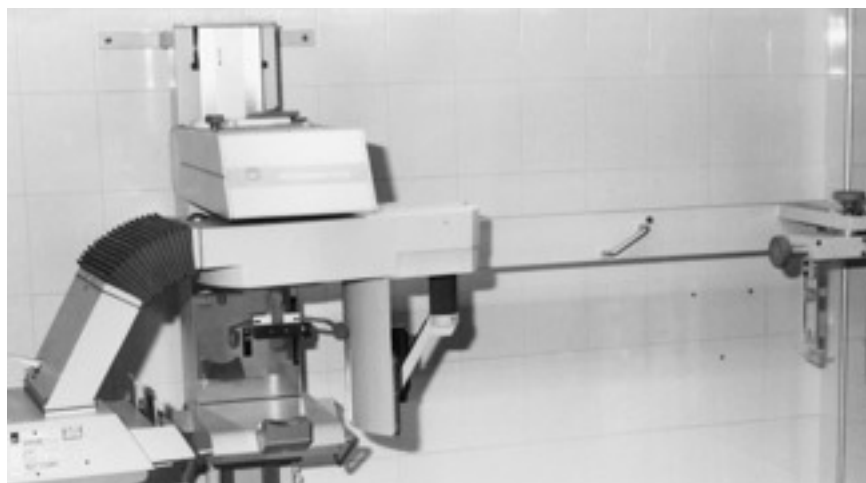


FIGURE 4 - Rotograph Plus apparatus (Villa Sistemi Medicali, Itália).

The radiographs were numbered at random from 1 to 60 and assessed by six examiners (three orthodontists and three radiologists) using a negatoscopy with cold light and a bask mask. Each examiner organized the sample according with criteria of image quality leading to an ordered sequence of exams in which the radiographs with top quality were the first ones.

Non-parametric statistical methods were used to evaluate the relevance of the obtained results degree of agreement inter-observer was assessed with the Separman correlation coefficient. After that the test of Kendall was used for concordance to assess if the inter-observer concordance was significant, and the test of Mann-Whitney to verify whether there was or not statistical significant difference between the compared equipments (COSTA NETO, 1977).

RESULTS

Results for the Spearman correlation coefficient can be seen in TABLE 1.

TABLE 1 – Spearman correlation coefficient - comparison of the level of agreement between examiners. Evaluation based in 60 radiographs.

Variable	Correlation	Probability (bicaudal)
E1 x E2	0.70	0.0000
E1 x E3	0.51	0.0000
E1 x E4	-0.00	0.9673
E1 x E5	0.69	0.0000
E1 x E6	0.64	0.0000
E2 x E3	0.66	0.0000
E2 x E4	0.02	0.8598
E2 x E5	0.56	0.0000
E2 x E6	0.70	0.0000
E3 x E4	0.12	0.3598
E3 x E5	0.40	0.0013
E3 x E6	0.55	0.0000
E4 x E5	-0.12	0.3509
E4 x E6	0.27	0.0382
E5 x E6	0.62	0.0000

E=examiner

Exact probability for N<12.

Results led to the removal of the data from one of the examiners. The test of concordance of Kendall of the remaining five examiners showed a coefficient of 0.68 (p=0.0000), which has statistical significance. Subsequently, the means for the five positions attributed by the examiners were calculated and the results were treated by the Mann – Whitney test (TABLE 2) obtaining a p=0.000, which indicates differences with statistical significance between the equipments. Based on the adopted criteria by the five examiners, it is possible to conclude that the Roentax equipment provides better image quality exams.

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TABLE 2 – comparison between the Rotograph Plus system (A) and the adapted radiogocic system (B) using the Mann-Whitney test.

system	mean	median	Sum of ranks	Mean rank	number
A	39.0	40.5	1229.0	41.0	30
B	22.0	19.8	601.0	20.0	30

U = 136.000000

Aproximation to normal: Z = 4.6426

Probability = 0.0000

Alternative hypothesis: A <> B

CONCLUSION

With the adopted methodology and taking into consideration the results obtained, we conclude that the radiographic system adapted at the HRAC provided exams with image quality superior to those obtained with the conventional equipment.

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