



Reject Analysis of Extraoral Dental Radiography Examination at The Dental Hospital in Semarang, Indonesia

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ABSTRACT

Film rejection analysis is the process of calculating repeated exposure and determining the causes of repetition, so that they can be minimized or even eliminated. This study aims to determine the rejection ratio of films from extraoral dental radiography examinations, as well as the causes of each rejection percentage and efforts to reduce it. This study has a quantitative model with a descriptive approach. The research was conducted at the Radiodiagnostic Department of the Dental Hospital, Universitas Muhammadiyah Semarang in January-June 2022 with a total number of 232 radiographic film data. There were 4 radiographs that were rejected with the factors causing patient movement (50%), patient position (25%), and modality settings (25%). The film rejection ratio in the Radio-diagnostic Department of the Dental Hospital, Universitas Muhammadiyah Semarang is 1.7% (< 2%) so that a repair program is not needed.

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I. INTRODUCTION

Extraoral radiographic examination is the entire dental radiographic examination of the orofacial region with receptors placed outside the patient's mouth (1). Extraoral examination is used to evaluate areas not covered by intraoral radiographs or to evaluate the facial structure as a whole. There are several types of extraoral examination, such as panoramic, cephalometric, temporomandibular joint (TMJ), and Cone Beam Computed Tomography (CBCT) (2).

Extraoral radiographic techniques have a lower patient invasive rate than intraoral radiography techniques (3). However, the extraoral radiography technique has shortcomings on the side of image formation which often experience distortion due to errors in the image formation process on the computer. There are other factors that cause failure in extraoral radiography, such as positioning, exposure factors, object movement, artifacts and unidentified errors (4).

According to Suraningsih (2015), the exposure factor is the biggest factor causing film's rejection with a percentage of 29.03%. Other causes

are artifacts (22.58%), movement (16.12%), film processing (16.12%), fog (9.67%), and patient position (6.45%) (5). Meanwhile, according to Benza (2018), the causes of the film's rejection successively were patient position (63%), exposure factor (24.9%), gridlines (1.7%), collimation (2.2%), absence of markers anatomy (2.8%), and artifacts (5.5%) (6).

There are various kinds of research results regarding the factors causing the rejection of radiographic films that have been analysed in various places. Therefore, the author intends to find out the factors that cause film rejection at the Radiodiagnostic Department of the Dental Hospital, Universitas Muhammadiyah Semarang. Then later it is used as quality assurance and quality control material which aims to minimize the occurrence of photo rejection and repetition to maximize the quality of the resulting radiographic image and increase patient satisfaction. Because the higher the rejection value of the film that occurs, the patient satisfaction will decrease (4,7).

Analysis of the film's rejection according to Jabbari, et al (2012), is an important component of a quality assurance program. Film rejection analysis

involves periodic evaluation of the results of radiographic images as a form of radiodiagnostic service (8). Film rejection analysis is a relatively inexpensive and easy management activity to implement. With film rejection analysis, identification of problems related to patient care can be identified and service quality can be improved. In addition, through the analysis of the film's rejection, it can also be seen that the ratio of rejected radiographs to the total number of radiographic examinations can be used and can then be used as a basis for calculating cost effectiveness. Calculation of cost effectiveness can be done by calculating the resources that must be wasted due to errors that occur in the service, such as consumption of consumables, examination time, or patient radiation dose (4,9,10).

Economical calculations on extraoral dental radiographic examinations can be made when film rejection analysis is applied. This is because by analyzing the rejection of the film, we know the number of rejected radiographic images and the reasons for rejection, including the associated costs. The estimated annual costs can be determined based on the calculation of the average cost loss based on the value of the proportion of a film's rejection that occurs during the radiodiagnostic department (9).

On the other hand, time in radiodiagnostic services is also a fairly important variable in determining the effectiveness of services for patients. The delay in an inspection procedure due to repeat inspections will have an impact on the total service time in a day. The process of making expertise, diagnosis of examinations is also delayed so that the effectiveness and efficiency of services are disrupted. By doing an analysis of the film's rejection, the problem of delayed examination time will be easily resolved (11). The objectives of the film rejection analysis are to improve the quality of care for patients, promote the effective use of resources, improve the provision and organization of clinical services, and continue professional education and training (12).

The need for a quality assurance program within the framework of film rejection analysis in the radiodiagnostic department section is still a matter of interesting discussion and debate. It is explained in many literatures and scientific studies that due to the transition from conventional to digital imaging technology, the existence of film rejection analysis becomes inaccurate because of the latest technology that does not use film. Digital images are created using reusable imaging plates,

and expertise can be created directly through the monitor. In fact, the analysis of the film's rejection is still needed because it turns out that the rejection rate for films and digital images cannot be made zero (zero reject) (10,13–15).

Considering the complexity of the categories or factors that cause repetition of errors in extraoral dental radiography examinations, in this study the factors that cause recurrence must be determined first which refers to the conditions of service. Thus, there are 7 factors that will be studied, including the error factors related to (4,16): positioning, exposure factor, patient movement, modality settings, artifact, no marker, other causes.

2. MATERIALS AND METHODS

The type of scientific study in this research is quantitative and descriptive which involves an analytical approach process known as film rejection analysis at a radiodiagnostic facility. The location of the research was carried out in the Radiodiagnostic Department of the Dental Hospital, Universitas Muhammadiyah Semarang. Sampling was done by purposive random sampling. The total number of samples taken was 232 radiographic films.

The research data was obtained by using a retrospective-survey approach and using the observation method. The results of the analysis use the Microsoft Excel 2021 application. To get the overall film rejection ratio, the author uses the following formula (4):

$$\text{Rejection rate} = \frac{\text{Rejected film}}{\text{Total number of procedures}} \times 100\%$$

Meanwhile, to get the rejection ratio based on the category of causes of rejection using the following formula (4):

$$\text{Rejection cause} = \frac{\text{Rejected film by category}}{\text{Total rejected film}} \times 100\%$$

3. RESULTS

Film Reject Ratio

The total number of extraoral dental radiographic examinations was 232 examinations in January to June. There was a total of 4 radiographs that were rejected. So that the rejection ratio in the Radiodiagnostic Department of the Dental Hospital, Universitas Muhammadiyah Semarang is 1.7%.

Film Rejection Ratio Based on Casual Factor

In Table 2, the percentage of the causes of the film's rejection from the largest to the smallest

is due to patient movement (50%), patient position (25%), and device settings (25%).

Table 1. Film Rejection Ratio of Extraoral Dental Radiography Examination of Radiodiagnostic Department Period January – June 2022.

Month	Number of Procedures	Number of Rejection
January	47	2
February	30	0
March	40	1
April	27	0
May	23	0
June	65	1
Total	232	4
Rejection rate		1.7%

Table 2. Film Rejection Ratio of Extraoral Dental Radiography Examination of Radiodiagnostic Department Period January – June 2022.

Factors	Number of Rejection	Rates (%)
Positioning	1	25
Exposure factors	0	0
Patient movement	2	50
Modality setup	1	25
Artifact	0	0
Marker	0	0
Other reason	0	0

Film Rejection Ratio Based on Examination

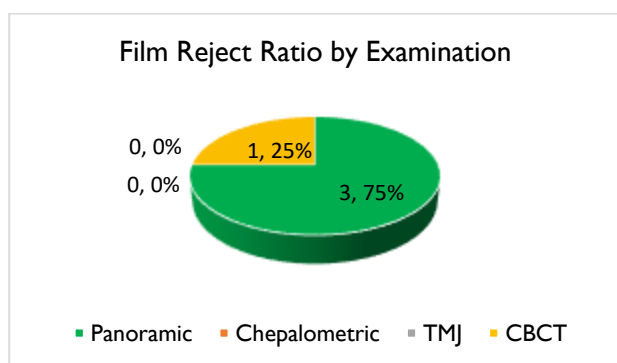


Figure 1. Film reject ratio by examinations.

It can be seen on Figure 1 that the largest percentage of the film's rejection occurred on panoramic examination, which was three times (75%). While the CBCT examination only once (25%).

4. DISCUSSION

Rejection analysis is an important part of the quality assurance program in radiodiagnostic departments to ensure reducing the factors responsible for rejection and thereby reducing

costs, workload, and radiation exposure to patients and personnel (17). Film rejection analysis provides



Figure 2. The image rejection of film due to incorrect setting of panoramic scan area in extraoral modalities.

useful information regarding facility rejection rates and more importantly, underlying causes of rejection that can be addressed in better ways to improve image quality, decrease rejection rates, reduce patient radiation exposure, reduce costs, optimize device performance and reduce staff load.

Referring to Table 1, it is known that the percentage of the film's rejection that occurred during the Radiodiagnostic Department of the Dental Hospital, Universitas Muhammadiyah Semarang was 1.7%. These results do not exceed the normal limit values set by the Minister of Health Regulation No. 129 Regarding Hospital Minimum Service Standards, < 2%.

The small percentage of rejected films at the Radiodiagnostic Department of the Dental Hospital, Universitas Muhammadiyah Semarang, is because the radiodiagnostic department already uses a digital image processing system. This is in line with the results of Alashban's (2022) study which revealed that the film's rejection was less common than conventional radiography (18).

The percentage of each causal factor determines the effect of a factor on the rejection that occurs every month. As shown in Table 2, the causative factors from highest to lowest in digital images are patient movement (50%), patient position (25%) and modality setting (25%). From these results, the one factor with the highest percentage is used as the basis for making repair efforts. In accordance with the author's agreement with the radiodiagnostic department, the data used is observational data between January and June 2022.

The efforts made are determined based on the dominant factors that cause rejection and repetition. Where the dominant factor causing

rejection and repetition in digital images is the patient movement factor by increasing effective communication with patients, as well as patient introductions. In addition, the use of immobilization tools is maximized for patients who do not have an introduction, either a family or a nurse.

The limitation of this study is data weren't constantly transferred from each workstation, a sizable amount of data was lost as a result of software updates and equipment failures that necessitated hard drive replacements. It is recommended that further research be undertaken that the data be downloaded frequently and prior to any planned system maintenance.

5. CONCLUSIONS

The rejection ratio of extraoral dental radiography examination films at the Radiodiagnostic Department of the Dental Hospital of Universitas Muhammadiyah Semarang was still below the normal limit value of 1.7%. No special efforts or programs have been made to improve service quality or reduce the number of film rejections that occur.

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AUTHORS' CONTRIBUTIONS

MJ designed conceptualization, study design and analysed the data, wrote the original draft, review and editing. WPG carried out the laboratory work, wrote the review and editing, validation, and visualization. All authors read and approved the final version of the manuscript.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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