Investigation of Extraoral Dental Radiography Examination Rejections at a Dental Hospital in Semarang, Indonesia

Dina Rusydiana¹*, Dona Doni Setyawan¹

¹Dental and Oral Hospital of Universitas Muhammadiyah Semarang, Indonesia.
*Corresponding author: dinarusydiana8@gmail.com

KEYWORDS
Dental, Hospital, Radiography, Extraoral

ABSTRACT

Background: Extraoral radiography techniques, such as panoramic radiography and cephalometric radiography, are used to obtain an overall view of the teeth, jaws, and surrounding tissues. However, there are instances where radiographic images are rejected or marked as inadequate based on the required quality standards. Reject analysis is a method of evaluation that involves analyzing rejected dental radiographic images. This research will identify the most common factors contributing to image rejection and provide recommendations for improving the quality of dental radiographic images.

Method: The type of scientific study in this research is quantitative and descriptive. The research was conducted at the Radiodiagnostic Department of the Dental Hospital, Muhammadiyah University of Semarang. The total sample size taken was 301 extraoral radiographic films. The research data were obtained through a retrospective survey approach and observation method. The analysis was performed using Microsoft Excel 2021 application.

Result: The primary factors contributing to film rejection are patient movement (50%), patient positioning (25%), and device settings (25%). Film rejection for extraoral radiographic examinations consisted of 2 films in Panoramic examinations, accounting for 50%, and 2 films in Cephalometric examinations, also accounting for 50%.

Conclusion: The film rejection ratio for extraoral dental radiography examinations conducted at the Radiodiagnostic Department of the Dental Hospital, Universitas Muhammadiyah Semarang, remained below the normal limit value of 1.29%.

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I. INTRODUCTION

In radiology practice, extraoral dental radiography is an essential component of dental care. Extraoral radiography techniques, such as panoramic radiography and cephalometric radiography, are used to obtain an overall view of the teeth, jaws, and surrounding tissues. In dental radiology practice, the quality of the radiographic images obtained is crucial for diagnosing dental conditions and planning appropriate treatment for patients. However, there are instances where radiographic images are rejected or marked as inadequate based on the required quality standards.

Reject analysis is a method of evaluation that involves analyzing rejected dental radiographic images. The aim of reject analysis is to identify the factors contributing to image rejection and understand their impact on radiological interpretation and patient treatment planning. Through this analysis, dental hospitals or radiology facilities can gain valuable insights into technical issues, image quality problems, or other factors that may affect interpretation and diagnosis.

Several previous studies have been conducted to analyze reject analysis in dental radiography, both in the context of extraoral and intraoral examinations. For example, investigated the factors contributing to panoramic radiography image rejection. The study identified technical issues, such as improper patient positioning or patient motion, as the primary factors leading to image rejection. On the other hand, discussed...
reject analysis in periapical radiography in dental radiology practice. The study highlighted the importance of proper technical settings, including exposure factors and positioning techniques, in avoiding image rejection.

However, there is still a lack of information in the literature regarding reject analysis in extraoral dental radiography. Therefore, this study aims to analyze and evaluate rejected extraoral and intraoral dental radiographic images at a dental hospital in Semarang, Indonesia. This research will identify the most common factors contributing to image rejection and provide recommendations for improving the quality of dental radiographic images.

2. MATERIALS AND METHODS

The type of scientific study in this research is quantitative and descriptive, involving an analytical approach known as film rejection analysis in radiodiagnostic facilities. The research was conducted at the Radiodiagnostic Department of the Dental Hospital, Muhammadiyah University of Semarang. Sampling was done using purposive random sampling method. The total sample size taken was 301 extraoral radiographic films. The research data were obtained through a retrospective survey approach and observation method. The analysis was performed using Microsoft Excel 2021 application. To obtain the overall film rejection ratio, the following formula was used:

\[
\text{Rejection ratio} = \frac{\text{Number of rejected films}}{\text{Total number of processed films}} \times 100\%
\]

Meanwhile, to obtain the rejection ratio based on rejection cause categories, the following formula was used:

\[
\text{Category rejection ratio} = \frac{\text{Number of rejected films in a specific category}}{\text{Total number of rejected films}} \times 100\%.
\]

3. RESULTS

a. Film Reject Ratio

The total number of extraoral dental radiographic examinations conducted during the period from January to June 2023 was 301 examinations. Out of this number, 4 radiographs were rejected, resulting in a rejection ratio of 1.33% at the Radiodiagnostic Department of the Dental and Oral Hospital, Universitas Muhammadiyah Semarang.

b. Film Rejection Ratio Based on Casual Factor

Table 2 presents the distribution of causes for film rejection, listed in descending order from the most to the least significant. The primary factors contributing to film rejection are patient movement (50%), patient positioning (25%), and device settings (25%).

### TABLE 1.

<table>
<thead>
<tr>
<th>Month</th>
<th>Number of Procedures</th>
<th>Number of Rejection</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>96</td>
<td>2,00</td>
</tr>
<tr>
<td>February</td>
<td>115</td>
<td>2,00</td>
</tr>
<tr>
<td>March</td>
<td>100</td>
<td>0,00</td>
</tr>
<tr>
<td>Total</td>
<td>311</td>
<td>1,29%</td>
</tr>
</tbody>
</table>

### TABLE 2.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Number of Rejection</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positioning</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Exposure Factors</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Patient</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Movement</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Artefact</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Other Reason</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
From the diagram, it can be observed that the film rejection for extraoral radiographic examinations consisted of 2 films in Panoramic examinations, accounting for 50%, and 2 films in Cephalometric examinations, also accounting for 50%.

4. DISCUSSION

Analyzing rejected films is a crucial component of quality assurance programs in radiodiagnostic departments. It helps identify and address factors contributing to rejection, leading to reduced costs, workload, and radiation exposure for both patients and personnel. Film rejection analysis provides valuable insights into rejection rates and underlying causes, allowing for improvements in image quality, reduction in rejection rates, decreased patient radiation exposure, cost savings, optimized device performance, and reduced staff burden.

Referring to Table 1, it is evident that the percentage of film rejection in the Radiodiagnostic Department of the Dental Hospital, Universitas Muhammadiyah Semarang, was 1.7%. These results fall within the acceptable range set by the Minister of Health Regulation No. 129 on Hospital Minimum Service Standards, which is less than 2%. The low percentage of film rejections in the Radiodiagnostic Department of the Dental Hospital, Universitas Muhammadiyah Semarang, can be attributed to the use of a digital image processing system. Demonstrated that film rejection is less common in digital radiography compared to conventional methods. The percentage of each causal factor indicates the impact of these factors on monthly rejections. As presented in Table 2, the main contributing factors to film rejection in digital images are patient movement (50%), patient positioning (25%), and modality settings (25%). Based on these results, efforts should focus on addressing the factor with the highest percentage. In line with the agreement between the author and the radiodiagnostic department, the observational data used in this study covers the period from January to June 2022.

Efforts should be targeted at the dominant factors causing rejection and repetition. In the case of digital images, patient movement is the primary factor. Effective communication with patients, providing proper instructions, and maximizing the use of immobilization tools for patients without introductions (such as family members or nurses) can help mitigate this issue. One limitation of this study is the lack of continuous data transfer from each workstation. A significant amount of data was lost due to software updates and equipment failures that necessitated hard drive replacements. It is recommended for future research to download data frequently and before any planned system maintenance to mitigate data loss.
5. CONCLUSIONS

The film rejection ratio for extraoral dental radiography examinations conducted at the Radiodiagnostic Department of the Dental and Oral Hospital, Universitas Muhammadiyah Semarang, remained below the normal limit value of 1.29%. Currently, no specific efforts or programs have been implemented to enhance service quality or reduce the occurrence of film rejections.

ACKNOWLEDGMENTS

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AUTHORS’ CONTRIBUTIONS

DR contributed to compiling and collecting data while DDS contributed to analyzing and drafting the manuscript.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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