

# COMPARISON OF BITEWING RADIOGRAPH QUALITY BETWEEN SILICON LOOP AND FILM HOLDER

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**Abstract :** Bitewing radiography is an intraoral radiography to view the tooth surface which includes the crown of the tooth as well as the alveolar crest of the upper and lower jaw at the same receptor. The use of film holders and silicone loops in the bitewing technique helps standardize taking radiographs, but there has been no research that shows a comparison of the quality of radiographs using silicone loops and film holders. This study aimed to compare the quality of bitewing radiography using silicone loops and film holders. This study is observational analytics comparative study using 24 radiograph bitewings. Bitewing radiograph was done by taking radiograph using dental cast with ten natural teeth which is caninus, premolar, and molars maxilla and mandible on one side of the jaw. The results showed there is not significantly difference between bitewing radiograph quality using silicon loop and film holder with  $p\text{-value} > 0,05$ , for coverage object, density, contrast, sharpness, geometry, and overlapping. Silicon loop can be used as alternative device for taking bitewing radiograph.

**Keywords:** *film holder, radiograph quality, bitewing radiograph, silicon loop*

## INTRODUCTION

Radiographic examination in the field of dentistry has a role as a supporting examination to assist dentists in determining the diagnosis, determining the treatment plan, and evaluating the results of treatment that has been carried out previously by dentists.<sup>1,2</sup> One of the current radiographic examinations is bitewing radiography.

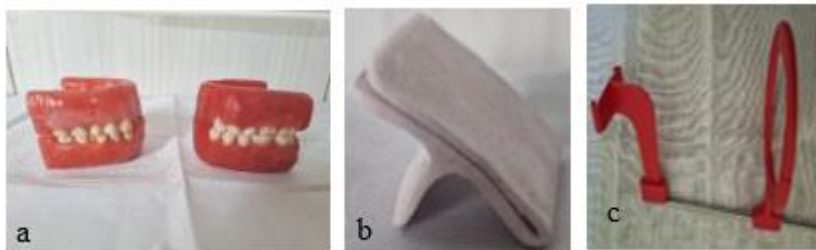
Bitewing radiograph is one of the intraoral radiographs to view the tooth surface that includes the crown of the tooth as well as the alveolar crest of the maxilla and mandible at the same receptor.<sup>3</sup> Bitewing radiographs are indicated to detect carious lesions, view caries progression, assess existing restorations, determine the status of periodontal tissues and to view calculus at the interproximal level.<sup>3,4,5</sup> Bitewing radiographs are performed for examination of posterior teeth that cannot be visually inspected.<sup>6</sup>

Bitewing radiographic images are usually taken using bitewing tabs or film holders. The film holder is used to stabilize the film during irradiation and prevent vertical and horizontal angular angulation errors.<sup>3,7</sup> The use of a film holder has the disadvantages of causing discomfort to the patient, the price is relatively expensive, less suitable for use in children, and the position of the film holder in the mouth depends on the operator's skill so the image cannot be 100% reproduced.<sup>4</sup> The use of film holders can still cause overlapping as reported by Safi et al. that as much as 61.4% of the use of conventional film holders caused overlapping.<sup>8</sup> Another receptor stabilization tool is the paper loop. The paper loop has the disadvantage, the movement of the tongue can cause movement of the film.<sup>3,7</sup> Kositbowornchai et al. reported that the use of paper loops had a 1.11 times greater chance of overlapping than using a film holder.<sup>9</sup>

Another alternative to paper loops is silicone loops. Silicone loop is a new item modified from paper loop which has advantages including elastic, soft, and environmentally friendly. Prativi et al. reported that there was no significant difference in quality between radiographs using silicone loops and paper loops.<sup>10</sup> The aim of this study was to compare the quality of bitewing radiographs using silicone loop and film holders.

## METHODS

This study was a comparative analytic observational study. The first procedure was that a study model made of wax was implanted with ten natural teeth, namely canines, first premolars, second premolars, first molars and second molars of the maxilla and mandible on one side of the jaw (Figure 1).



**Figure 1.** Research materials (a) Study model, (b) Silicon loop, and (c) Film holder

The next step is taking bitewing radiographs using silicone loops and film holders. Based on the results of calculating the number of samples using the

Federer, researchers used 12 samples from each radiograph using silicone loops and film holders.<sup>11</sup>

The tab on the silicone loop and the bite plate on the film holder were positioned in the center of the film and parallel to the upper and lower edges of the film. The film was placed between the tongue and the tooth, parallel to the tooth axis, the anterior border reaching the contact area between the mandibular first canine and premolar. The tab on the silicone loop and the bite plate on the film holder were placed on the occlusal surface of the mandible then the study model was occluded. The x-ray tube was positioned at a vertical angle of 5-10 degrees to the horizontal plane towards the film and a horizontal angle directed towards the interproximal region of the teeth (Figure 2).<sup>3,7,12</sup> The researcher used an apron, and x-rays were exposed using a Phot X II 303-H x-ray machine (Belmont, USA) with 60 kVp and 7 mA and a time of 0.32 seconds. Then the film was washed and processed. Figure 2. Bitewing radiograph procedure (a) the film is positioned in the center of the silicone loop and film holder, (b) positioning the x-ray tube in a vertical angle



**Figure 2.** Bitewing radiograph procedure (a) the film is positioned in the center of the silicone loop and film holder, (b) positioning the x-ray tube in a vertical angle

The assessment of radiographic quality based on object coverage, density, contrast, sharpness, geometry, and overlapping. Then compared the quality of radiographs between silicone loops and film holders. Data analysis in this study used comparative test analysis which aims to determine whether there is a significant difference in the results obtained in the quality of bitewing radiographs using silicone loops and film holders. Then the data was analyzed using the Mann-Whitney test ( $p < 0.05$ ) because the data was not normally distributed.

## RESULTS

Research on the comparison of the quality of bitewing radiographs using silicone loops and film holders was carried out by observing the results of bitewing radiographic photographs and continued by assessing the quality of radiographic results based on object coverage, density, contrast, sharpness, geometry, and overlapping intraobserver and interobserver. In the next stage, the Kappa test was conducted on the results of the quality assessment of bitewing radiographs using silicone loops and film holders. The Kappa coefficient value obtained on bitewing radiographs using silicone loops is 0.759 which is included in the substantial agreement category (Kappa value 0.61-0.80) and the Kappa value on bitewing

radiographs using a film holder is 0.902 which is included in the almost perfect agreement category (Kappa value 0.81-1.00).

The results of bitewing radiographs using silicone loops and film holders are shown in Figure 3 and figure 4. Data from the kappa test were then processed using the Mann-Whitney non-parametric alternative test. The results of the Mann-Whitney test can be seen in table 1.

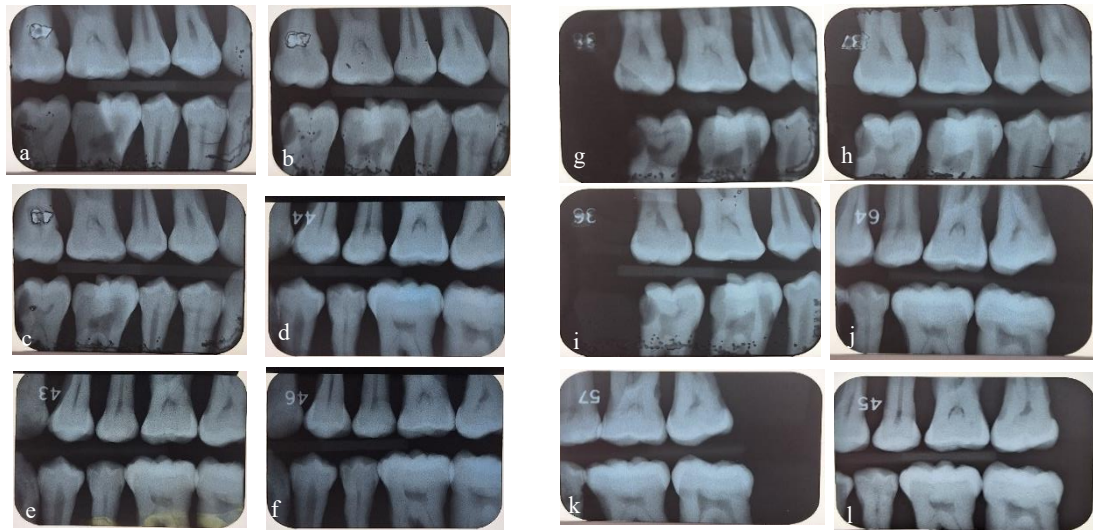
**Table 1.** The Mann-Whitney Test Results.

Parameters	Silicone Loops	Film holders	P value
Object Coverage			
Good	8 (66,7%)	10 (83,3%)	0,356
No	4 (33,3%)	2 (16,7%)	
Total	12 (100%)	12 (100%)	
Density			
Good	11 (91,7%)	12 (100%)	0,317
No	1 (8,3%)	0 (0,0%)	
Total	12 (100%)	12 (100%)	
Contrast			
Good	12 (100%)	12 (100%)	1,000
No	0 (0,0%)	0 (0,0%)	
Total	12 (100%)	12 (100%)	
Sharpness			
Good	10 (83,3%)	11 (91,7%)	0,546
No	2 (16,7%)	1 (8,3%)	
Total	12 (100%)	12 (100%)	
Geometry			
Good	10 (83,3%)	12 (100%)	0,148
No	2 (16,7%)	0 (0,0%)	
Total	12 (100%)	12 (100%)	
Overlapping			
Yes	5 (41,7%)	2 (16,7%)	0,187
No	7 (58,3%)	10 (83,3%)	
Total	12 (100%)	12 (100%)	

(p value: 0.05; the highest p value was 1.0 and the lowest p value was 0.148.)



**Figure 3.** Radiographic image of bitewing radiographs using silicone loop



**Figure 4.** Radiographic image of bitewing radiographs using film holders

The Mann-Whitney test analysis in table 1 shows that the p value in all radiographic quality parameters is  $p > 0.05$ , which means that there is no significant difference between the radiographic quality of bitewing using a silicone loop or film holder.

## DISCUSSION

Silicone material is a synthetic polymer material derived from polydimethylsiloxane (PDMS) that has been used in medical practice for more than 60 years.<sup>13</sup> Silicone loop is a modification of the paper loop to solve the shortage of the paper loop. Silicone material is hydrophobic, has high resistance, chemically and temperature stable and can be sterilized using an autoclave without any changes.<sup>10,14</sup> Silicone also has good biocompatibility, high elasticity, low surface tension and toxicity, and radiation resistance.<sup>14,15,16</sup>

Based on visual observation of bitewing radiographs using silicone loops on the parameters of density, contrast, sharpness, and geometry, the results are quite good. The density of a radiograph is influenced by exposure factors, thickness and density of the object. The silicone loop material causes the absorption of x-rays to be slightly absorbed by the silicone and the object so that changes in image density occur.<sup>10</sup> The contrast of a radiograph depends on the subject contrast and film contrast.<sup>3</sup> Sharpness in radiographs can be affected by several factors including focal spot size, film composition, and movement of the subject or film during exposure.<sup>12</sup> In the geometry parameters, several things that can affect the geometry of a radiograph are the positioning of the x-ray tube at the correct angulation and the placement of films and objects that are parallel and as close as possible.

Assessment of the quality of bitewing radiographs on the object coverage parameter shows that the results of bitewing radiographs using silicone loops have an unfavorable proportion between the maxillary and mandibular teeth. This is due to the improper placement of tabs between the upper and lower jaws, and the incorrect position of the tube head when irradiating. Kositbowornchai et al. research, the loop technique was 1.12 times more likely to experience positional errors than the holder technique.<sup>9</sup>

Assessment of overlapping on bitewing radiographs using silicone loops showed that there was more overlapping compared to bitewing radiographs using a film holder. This is because the tubehead not been directed perpendicular to the interproximal region of the dentition, resulting in superimposed images of the adjacent tooth contact area. Herman et al. reported that the overlapping of proximal surfaces on bitewing radiographs was very high, as much as 58.2% of 298 radiographs.<sup>17</sup> Rasid et al. also reported that frequent errors in bitewing radiographs were overlapping (57.9%), off-center film placement (38.8%), inadequate contrast and density (19.2%), and inadequate object coverage (10%).<sup>18</sup>

Based on table 1, the quality of bitewing radiography parameters of object coverage, density, contrast, sharpness, geometry and overlapping on bitewing radiographs using silicone loops or film holders have good quality. Both have no significant difference when viewed from the p value ( $p > 0.05$ ). Difficulties in this study include positioning the tube head, film, and study model. This study uses a study model, it is necessary to take bitewing radiographs using silicone loops directly to assess the patient's comfort level. Future research is recommended to perform bitewing radiographs directly on patients using silicone loops. In conclusion, silicone loops can be used as an alternative for taking bitewing radiographs because the quality of the radiographs (object coverage, density, contrast, sharpness, geometry, and overlapping) is not significantly different from using a film holder.

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