

## **Occlusal Vertical Dimension Analyzed By Digital Photography Using Graphic Design Softwares**

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### **ABSTRACT**

The measurements of occlusal vertical dimension (OVD) is very important in the process of making denture. One method of them is indirectly with digital photography analysis using graphic design softwares. Some softwares used in digital photo analysis are cheap and easy for generalized use. There are several other softwares often used by graphics professionals that its application is a little more difficult. This study aimed to compare in the measurement results of occlusal vertical dimension analyzed by digital photography using graphic design softwares, and it was expected that their results approached the direct method. This study was an observational analytic study with a cross-sectional approach. The total sample in this study was amounted to 30 pre-clinical and clinical dentistry study programs at Universitas Sriwijaya. The measurements of occlusal vertical dimension were measured from subnational to menton in an occlusion state using the direct method (Willis) (control) and digital photography analysis of both softwares (Adobe Photoshop and Coreldraw). Data were tested using one-way ANOVA test. One-way ANOVA test results showed differences in the occlusal vertical dimension between the direct method and digital photography analysis of both softwares were not significant ( $P > 0.5$ ). There was no difference in the results of the occlusal vertical dimension between the groups.

Keywords: vertical dimension, digital photography, graphic design softwares

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### **1. INTRODUCTION**

Determination of occlusal vertical dimension (OVD) is a very important procedure for patients with a history of full edentulous because it can be affect the process of making a full denture accuracy.<sup>1</sup> If there is a error measurement in determining OVD then it can worsen the patient's condition, which can cause pain in masticatory muscles if the OVD is too high. If OVD is too low, it can be offered in the appearance of lesions such as angular cheilitis.<sup>2,3</sup>

OVD measurements can be done in two direct (Willis method) and indirect (digital photography analysis) method. The direct measurement has the result of differences in angulation of the measuring instrument and pressure that can cause errors in the OVD result.<sup>1</sup> Wirahadikusuma states that it can

minimize by indirect measurements such as digital photo analysis.<sup>4</sup>

Digital photographs in the dentistry have been widely used in diagnostic and treatment planning.<sup>5</sup> It can be used in the process of making denture which is now widely applied in the use of Computer-Aided Design / Computer Aided Manufacturing (CAD / CAM) . Digital photographs can help use the CAD / CAM application to provide a 3D replica reference of a patient's face and a virtual appearance of the tooth and OVD determination information in the process of making denture.<sup>6</sup>

Effective OVD measurements on facial digital photos can be done by graphic design softwares. Both softwares are used to edit digital photographs image design forms. Wirahadikusumah's research was state that there was not significantly different between direct measurements (Willis method) and

digital photos using graphic design software.<sup>3</sup> Carvalho's research (2010) about differences in analysis of the joints ability of the hand (range of motion) with the goniometry (direct method) and digital photos using graphic design software, obtained results were not significantly different.<sup>7</sup> The advantage of some softwares are cheap and easy to use for images designing, but the loss in image quality when zoomed in. But the others that often used by graphic professionals, have magnified image quality resulting are fixed. The disadvantage of this software is, its application is a little more difficult.<sup>3,8-11</sup> It is expected that the results obtained some softwares approach to the direct method.

## 2. METHOD

This study was an observational analytic study with a cross sectional approach.<sup>12</sup> The research subjects were 30 pre-clinical and clinical dentistry study program at Universitas Sriwijaya who met the inclusion and exclusion criteria :<sup>3</sup>

### a. Inclusion Criteria :

- Minimum age of 18 years.
- Having a complete teeth that is up to second molar

### b. Exclusion Criteria :

- Having history of face surgery.
- Open bite or deep bite.
- Using dentures.
- Having orthodontic treatment.

Each sample was made of 3 different types of measurements, :

I. Group I (direct method) was as a control. The procedures were as follows:

- a. The subject was instructed to sit in a chair with his head held high and look forward.<sup>2</sup>
- b. The two anatomical points were measured on the subject's face (nose and chin base) are marked first using a black marker (Figure 6).

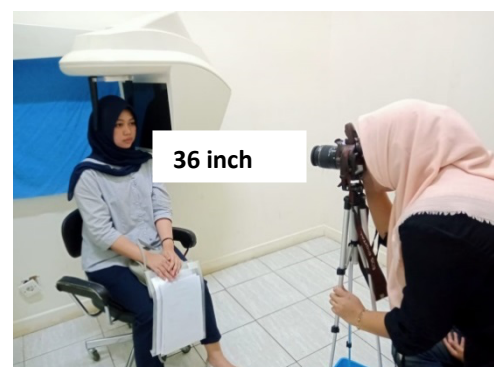


**Figure 6. Both anatomical points were marked**

- c. Subjects were asked to swallow so the teeth were contacted (occlusion).
- d. The directly of OVD measurements were measured from the base of the nose (angle of the nasolabial) to the chin (menton) using calipers. They were recorded twice and the results were averaged.

Taking digital photos on the same subject to get OVD was based on digital photo analysis using graphic design softwares with the following steps:

- a. A light blue photo background was prepared for taking photos.
- b. The distance of the camera to the subject was measured by 36 inches (91.44 cm) (Figure 7).<sup>13</sup>
- c. The camera was placed on a tripod for movement preventing during shooting so that distortion was not occur.<sup>13</sup>



**Figure 7. Distance of taking digital photos.**

- d. The camera settings were as follows:<sup>14</sup>
  - 1) The aperture value was set to be the smallest, it was maximized the depth of field (the level of object focus)

- 2) The lens camera magnification was adjusted with a ratio of 1: 1.
- e. Subjects who use glasses were asked to take off their glasses. Female subjects were asked not to use a makeup.
- f. Subjects were instructed to sit in chair. The head is fixed with a cephalostat (Figure 8). Subjects were asked to swallow so that the teeth contacted (occlusion).<sup>15</sup> Taking digital photos was done 2 times.



Figure 8. Sefalostat.<sup>16</sup>

- g. The results of the photo were analyzed by Adobe Photoshop software and computers.

II. Group II was based on digital photo analyzed using a graphic design software (Adobe Photoshop). (Figure 8).

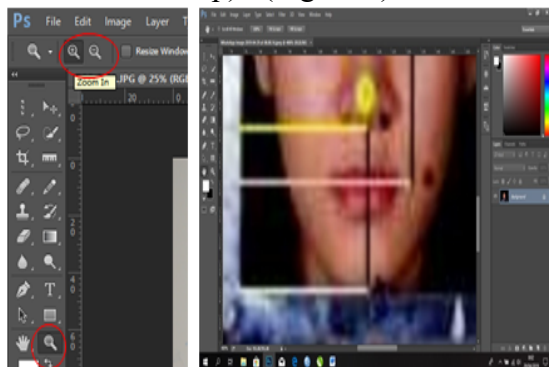


Figure 8. Digital photography using graphic design software.

- a. The two dots marked with markers (dots at the base of the nose and chin) were connected to the photo using the "Pencil Tool" measured by ruler application of software.

- b. The measurement results were recorded in millimeters.

III. Group III was based on digital photo analyzed using other graphic design software (Coreldraw), the procedure was same with group II.

### 3. RESULTS

The distribution of research subjects were could be seen in table 1.

Table 1. The average OVD size results are in accordance with measurement method

Measurement method	N	$\bar{X}$ (mm) $\pm$ Sb
Group I (control)	30	62,85 $\pm$ 4,23
Group II	30	62,81 $\pm$ 4,32
Group III	30	62,83 $\pm$ 4,35

Data normality test used the Shapiro-Wilk test with the results of normally distributed data ( $p > 0.05$ ). After that, Levene's test and the results of homogeneous data were obtained ( $p > 0.05$ ). The data was forwarded to the one way ANOVA test.

Table 2. Results of the one-way ANOVA test for OVD between measurement methods

Measurement method	N	Hasil Ukuran OVD (mm)		Sign.
		$\bar{X} \pm$ Sb	Selisih	
Group I	30	62,85 $\pm$ 4,23		
(control)	30	62,81 $\pm$ 4,32	0,04	0,999
Group II	30	62,83 $\pm$ 4,35	0,02	
Group III				

Based on table 2, the results of the study showed no difference between the groups ( $p > 0.05$ ).

#### 4. DISCUSSION

There was no difference between direct and indirect (digital photography using graphic design softwares) methods on this study. Photographs obtained are affected by the distance of the camera to the subject. The distance is usually used 36 inches to avoid the risk of image distortion so that a good quality image was produced.<sup>13,17</sup>

The type of camera was also influenced the results of OVD measurement. The camera used for dental photography was a DSLR (Digital Single Lens Reflex) type camera. DSLR camera produced the least amount of distortion on image result.<sup>18</sup> The ideal background for this photography was blue, because it could be used on all skin tones. White background can be caused shadows on the image, while black reduced the quality of image.<sup>19</sup>

The group III was most closely approached to the direct method. This group used a vector-based graphic design software. The type of image result was a resolution-independent, i.e. the image was not depending on resolution, which if the image was enlarged beyond its actual size that could be minimized the artifact image. Group II used a raster image based graphic design software, this image was a resolution-dependent which if the image was enlarged beyond its dimensions, the image could be artifacted.<sup>4,10,20</sup>

Between group II and III were not significant. The image resolution of this study used was 300 ppi (pixels per inch) with an enlargement of 200%. The range of Group II was 72-300 ppi, the image could be enlarged without artifact causing. In general, this software is often used widely. Group III used software that often requires by design professionals which is bit more difficult on its application.<sup>9-11,21</sup>

Coachman (2017) states digital photography analysis of both softwares, can also provide a reference to the virtual display of photos to guide the final denture design in CAD / CAM applications.<sup>22</sup> Digital photography is easy to

process, and stored in the form of softcopy computer for a long time period, which can be used as legal documentation, forensics and educational media-communication between patients and dentists and the laboratory. It requires a cephalometric unit that is useful for positioning and fixing the head so that the movement occurs when taking photos was minimized. Han (2010) provides the head fixing by only installing a cephalostat on a chair so that digital photography analysis can be done in the dentist's office.<sup>16,23</sup>

#### 5. CONCLUSION

There was no difference in the measurement of OVD digital photo analysis of both graphic design softwares.

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