

## COMPARISON OF OCCLUSAL VERTICAL DIMENSION USING ANALYSIS OF SEVERAL VERSIONS OF DIGITAL PHOTO SOFTWARES

<sup>1</sup>Rani Purba, <sup>2</sup>Feby Kuntum, <sup>3</sup>Puput Rizkika, <sup>4</sup>Sri W. Rais, <sup>5</sup>Arya Prasetya Beumaputra

<sup>1,4,5</sup>Department of Prostodontia, Dentistry Program, Faculty of Medicine, Sriwijaya University, Palembang, Indonesia  
<sup>2,3</sup>Dentistry Program, Faculty of Medicine, Sriwijaya University, Palembang, Indonesia

Email: [ranipurba@fk.unsri.ac.id](mailto:ranipurba@fk.unsri.ac.id)

---

### ABSTRACT

Digital photo analysis is an alternative method of measuring the vertical dimension occlusion (OVD) in the denture processing by using graphic design softwares such as bitmap and vector-based software. The 2020 version of bitmap software has advantages such as online data storage, and upsampling feature that is used to improve image quality as well as the 2020 version of vector software. This study aimed to compare the results of OVD measurements using the analysis of several versions of digital photo softwares and direct measurements (Willis Method). This study was an analytic observational study with a cross-sectional approach. The total sample in this study was 30 students of the Sriwijaya University Dentistry Study Program from previous studies, divided into 5 groups; group I Willis method, group II 2012 version of bitmap, group III 2012 version of vector, group IV 2020 version of bitmap, group V 2020 version of vector software. The OVD was measured from subnation to menton in occlusion using the Willis method and several digital photo software analysis methods. The data were tested using one-way ANOVA test. The results of the one-way ANOVA test showed OVD differences of the direct method and digital photo software methods were not significant ( $p>0.05$ ). There was no difference in the results of the occlusal vertical dimension between the groups.

**Keywords:** vertical dimension, digital photo, graphic design software

---

### 1. INTRODUCTION

Direct OVD measurement such as the Willis method is considered stable, accurate, easy and often used in making good dentures. However, errors in this method can occur when using a caliper which can injure the patient's skin.<sup>1,2</sup> An alternative method of measuring OVD is with digital photos which can provide convenience during the process of making dentures.<sup>3-6</sup> Digital photos can be combined with the results of 3D facial scans in the process of making dentures which are currently widely applied in the Computer Aided Design/Computer Aided technology. Manufacturing (CAD/CAM), reducing time for patient visits and manufacturing in the laboratory, and giving satisfaction of patients and dentists.<sup>6,7</sup>

Wirahadikusumah, et al (2012) stated that there was no significant difference between direct OVD measurements (Willis) and digital photos. This study was used graphic design software analysis.<sup>2</sup> The development of graphic design technology supports the measurement and analysis of digital photos using bitmap and vector-based software. Bitmap is an image formed by several pixels point, and loss of its quality when zoomed in. Vector is an image formed by lines and curves that can be enlarged.<sup>8</sup> Compared to the previous version that is often used (the 2012 version), the advantages of the 2020 version of the bitmap software are online data storage, and the upsampling feature which is used to improve image quality.<sup>9-11</sup>

OVD measurement on digital photos with the analysis of this latest version of the softwares is expected to approach the results of the measurements directly. In addition, the importance of this study can provide information about the effectiveness of using digital photos in the the OVD's analysis as an alternative or additional method to complement the existing methods.

## 2. METHOD

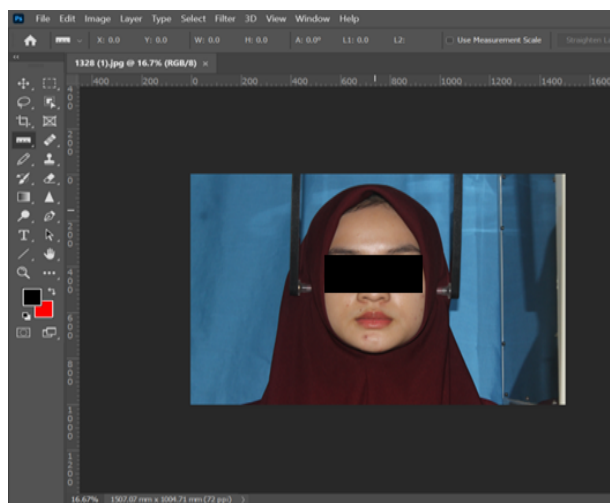
This research is an analytic observational study with a cross sectional approach that has been conducted in May 2021. The subject's data of this research were as below:

1. Secondary data: OVD value data from previous research (approved) were 30 digital photos of pre-clinical and clinical dentistry study programs at Sriwijaya University who met the inclusion and exclusion criteria.<sup>12,13</sup> Group I (Willis/ direct method, as a control, the OVD distance was measured from the base of the nose (nasolabial angle) to the chin (menton) during occlusion, taking digital photos on the same subject (using a Canon EOS 1100D DSLR camera with a 50 mm lens with a distance of 36 inches from subject) for getting OVD was based on digital photo analyzed using the 2012 version of bitmap (Adobe Photoshop) (group II), the 2012 version of vector (Coreldraw) (group III) design software.

2. Primary data: digital photos measurements were based on digital photo analyzed using the 2020 version of bitmap (Adobe Photoshop) (group IV), the 2020 version of vector (Coreldraw) (group V) design software.

The stages of digital photo analysis using the 2020 version of bitmap software were as below:<sup>10</sup>

1. The 2020 version of bitmap software was opened. A new screen was appeared, (after the sample file was opened from the file folder), it was opened and ready to be analyzed (Figure 1).



**Figure 1.** Display of the 2020 version of bitmap software after the file to be analyzed was opened

2. It was clicked the "Crop Tool" menu and "selected a ratio of 4 : 5"(Figure 2).<sup>14</sup>



**Figure 2.** Display of the "Crop Tool" menu.

3. It was drawn a line from the "Y-Axis" to the base of the nose, drawn another line from the "Y-Axis" to the chin base, drawn a line from the "X-Axis" right at the midpoint from the nose base to the chin base (Figure 3).



**Figure 3.** Display of the lines drawn from the X and Y axes.

4. Connect the two marker points (subnasal-menton point) on the photo using the “Pencil Tool” (Figure 4).

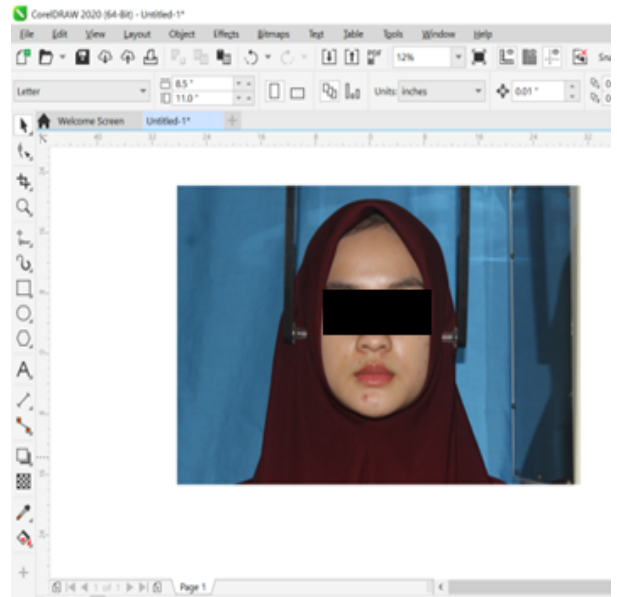


**Figure 4.** Display of the two marker points (subnasal-menton point)

5. The measurement results were recorded in millimeters.

The stages for analyzing digital photos using the the 2020 version of vector software were as below:<sup>11</sup>

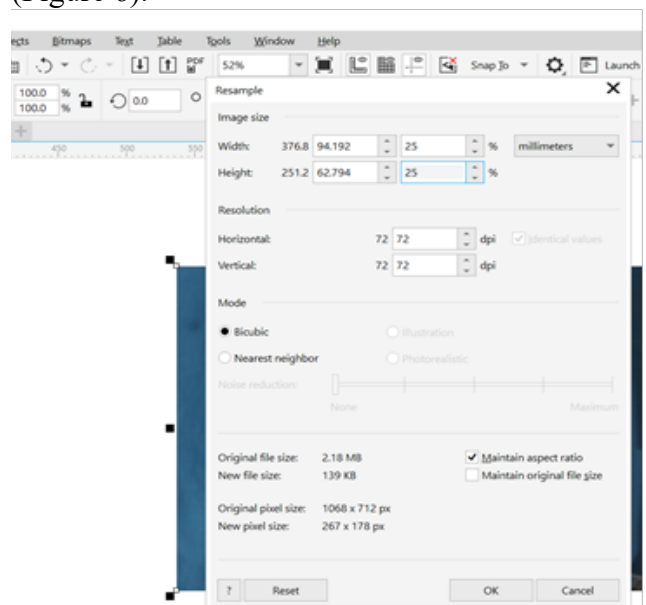
1. The 2020 version of vector software was opened. A new screen was appeared, (after after the sample file was opened from the file folder) it was opened and ready to be analyzed (Figure 5).



**Figure 5.** Display of the 2020 version of vector software after the file to be analyzed was opened

2. The image was enlarged using the "Zoom Tool" menu.

3. It was clicked the "Resample" in the "Image Size" menu. In the "Width" and "Height" box was changed to "25" and the unit was to be "Millimeters" as the calibration (Figure 6).



**Figure 6.** Display of the "Resample" menu.

4. The vertical dimension of the occlusion was measured using the "Parallel Dimension" which was located on the left side of the computer screen in the "Toolbox" menu, this feature was used as a ruler in the 2020 version of vector software (Figure 7).

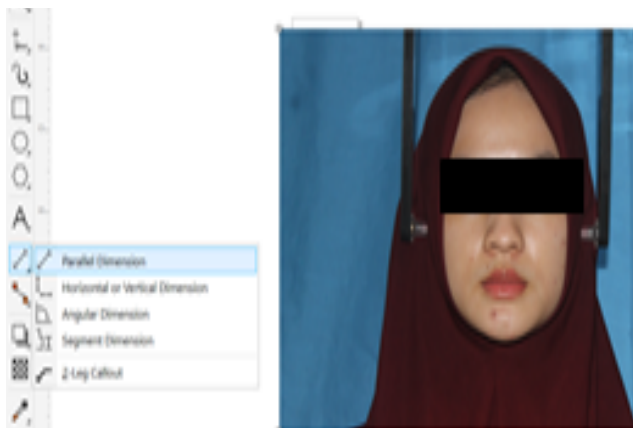


Figure 7. Display of the "Parallel Dimension" in the toolbox menu.

5. The measurement results were recorded in millimeters.

### 3. RESULTS

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

Table 1. The average OVD results were in accordance with measurement methods

Measurement method	N	$\bar{X}$ (mm) $\pm$ Sb
Group I(control)	30	62,847 $\pm$ 4,23
Group II	30	62,807 $\pm$ 4,32
Group III	30	62,811 $\pm$ 4,36
Group IV	30	62,808 $\pm$ 4,23
Group V	30	62,826 $\pm$ 4,23

Data were analyzed with the normality test using the Shapiro-Wilk test with the results of normally distributed ( $p > 0.05$ ). After that, data were analyzed with Levene's test and the results were homogeneous ( $p > 0.05$ ). 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	The results of OVD (mm)		Sign.
		$\bar{X} \pm Sb$	Difference	
Group I (control)	30	62,847 $\pm$ 4,23		1.000
Group II	30	62,807 $\pm$ 4,32	0.04	
Group III	30	62,811 $\pm$ 4,36	0.03	
Group IV	30	62,808 $\pm$ 4,23	0.03	
Group V	30	62,826 $\pm$ 4,23	0.02	

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

### 4. DISCUSSION

Based on the results of the study, there were no differences in the results of direct (Willis method) and indirect OVD measurements with digital photo software analysis. This showed that the OVD measurement value of the indirect method was closed to the direct measurement result. In a previous study conducted by Gomes VL et al., using a digital photo software (HLImage ++97) to measure the OVD distance between the corner of the eye to the lip commissure and the distance from the nose base to the chin base through digital photos compared to direct OVD measurements.<sup>4</sup> The results showed that there were no significant difference between direct and digital photos measurements, but this software was rarely used in Indonesia, so the researcher used other softwares that had the same features and functions were be measured by digital photos. This research was used the 2020 version of bitmap and vector software. This softwares were usually used for photo editing and the researcher had also found that this softwares were effective for measuring certain points on the digital photos of the faces. The measurement points in this study were located at the nose base (subnasal) and the chin base (menton).<sup>15</sup>

The results of the OVD value with digital photo software analysis were closest to direct

measurement (Willis method) was the 2020 version of vector software followed by the 2012 version of vector software. It is due to the vector images do not break even though they are enlarged from the actual image size, the image has higher quality and the measurement is obtained more accurate.<sup>16,17</sup> Another its advantage than the previous version of the 2012 version of vector software is equipped with a vector feathering feature which the function is increased transparency along the edges of the object, the image blends perfectly. The upsampling feature works to improve image quality for measuring the OVD, it can maintain the detail and sharpness without causing noise or the image looks broken even though no zoom (enlargement) is carried out when processed using the 2020 version of vector software.<sup>10,11</sup>

The next results of the OVD measurement that were closed to the direct method (Willis method) were the 2020 version of bitmap software and the 2012 version of bitmap software. This is due to the lack of bitmap images, if the image is enlarged (zoomed) the image will look broken, the measurement results become less accurate compared to the vector group. The 2020 version of bitmap software has advantages that the previous version (2012) does not have, it is equipped with a smart sharpen feature that helps to sharpen the image and it is more precise when determining the point in the measurement. Features that affect the measurement accuracy in this software are also due to the upsampling feature that can be to improve the quality and maintain image details in processed using the 2020 version software.<sup>10,11</sup>

The analysis of this digital photo softwares can be combined with the result of a 3D facial scan with the CAD/CAM technology in the process of determining the OVD in the manufacture of dentures, and this digital photo can also be used as a virtual patient display when preparing dental elements and as an online documentation tool when the patient will perform the next treatment.<sup>4,5,18</sup>

#### 4. CONCLUSIONS

There was no difference in the measurement of OVD using analysis of several versions of digital photo softwares. Further study is needed on the measurement of OVD digital photo analysis in partial or full edentulous patients and can provide new software innovations for helping process of dentures manufacture especially OVD measurement.

#### REFERENCES

- [1]. Cervino G, Fiorillo L, Arzukanyan AV, Spagnuolo G, Cicciu M. Dental restorative digital workflow: Digital smile design from aesthetic to function. *Dent J.* 2019;7(2):1-12.
- [2]. Wirahadikusumah A, Koesmaningati H, Fardaniah S. Digital photo analysis as a predictor of physiological vertical dimension. *JDI.* 2011;18(2):38-44.
- [3]. LeSage BP. CAD/CAM: Applications for transitional bonding to restore occlusal vertical dimension. *J Esthet Restor Dent.* 2019;32(2):1-9.
- [4]. Gomes VL, Goncalves LC, Correia CLM, Lucas BL, Carvalho PM. Vertical dimension of the face analyzed by digital photographs. *Eur J Esthet Dent.* 2008;3(4):362-70.
- [5]. Gunadi HA, Margo A, Burhan LK, Suryatenggara F, Setiabudi I. Ilmu geligi tiruan sebagian lepasan 1<sup>st</sup> ed. Gunadi HA, editor. Jakarta: Hipokrates; 2013.33-38 p.
- [6]. Srinivasan M, Kalberer N, Naharro M, Marchand L, Lee H, Muller F. CAD-CAM milled dentures: The Geneva protocols for digital dentures. *JPD.* 2020;123(1):27-37.
- [7]. Srinivasan M, Schimmel M, Naharro M, O'Neill C, McKenna G, Muller F. CAD/CAM milled removable complete dentures: Time and cost estimation



- study. *J Dent.* 2019;80:75-9.
- [8]. Enterprise J. Buku Latihan desain kartun dan karikatur dengan adobe illusator CS3. Jakarta: Elex Media Komputindo; 2007. Hal 34.
- [9]. Soeherman B, soeherman DD. Photo to cartoon with photoshop. Jakarta: Elex Media Komputindo; 2017. Hal 4-8.
- [10]. Adobe Photoshop.com: Compare versions [internet]. Amerika Serikat: AdobePhotoshop [updated date December 14, 2020; citation date 20 July 2020]:  
[https://www.adobe.com/sea/products/photoshop.html?sdid=12B9DXDJ&mv=search&ef\\_id=CjwKCAiAouD\\_BRBIEiwALhJH6JzmzhJzakt1jIpWpx7hk9d6Hv\\_s8keuMKEZBEuhb0Gq\\_6CGY6DxoC7u0QAvD\\_BwE:G:s&s\\_kwid=AL!3085!3!444512448900!e!!g!!adobe%20photoshop&gclid=CjwKCAiAouD\\_BRBIEiwALhJH6JGmzhJzakt1jIpWpx7hk9d6Hv\\_s8keuMKEZBEuhb0Gq\\_6CGY6DxoC7u0QAvD\\_BwE](https://www.adobe.com/sea/products/photoshop.html?sdid=12B9DXDJ&mv=search&ef_id=CjwKCAiAouD_BRBIEiwALhJH6JzmzhJzakt1jIpWpx7hk9d6Hv_s8keuMKEZBEuhb0Gq_6CGY6DxoC7u0QAvD_BwE:G:s&s_kwid=AL!3085!3!444512448900!e!!g!!adobe%20photoshop&gclid=CjwKCAiAouD_BRBIEiwALhJH6JGmzhJzakt1jIpWpx7hk9d6Hv_s8keuMKEZBEuhb0Gq_6CGY6DxoC7u0QAvD_BwE).
- [11]. Coreldraw.com: Compare versions [Internet]. Ottawa: CorelDRAW [updated date 14 December 2020; citation date 20 July 2020]:  
<https://www.coreldraw.com/en/product/coreldraw/index-rice.html?topNav=en>.
- [12]. Purba R, Yasmin U, Beumaputra AP, Rizkika P. Occlusal Vertical Dimension Analyzed By Digital Photography Using Graphic Design Softwares. *Majalah Kedokteran Sriwijaya.* 2020; 52(1) : 255-9
- [13]. Sinaga EK, Matondang Z, Sitompul H. Statistika: teori dan aplikasi pendidikan. Medan: Yayasan kita menulis; 2019. Hal 94.
- [14]. Learn photoshop cs6. Adobe System Incorporated. 2012; pp 4,5
- [15]. Costa MCC, Barbosa MC, Bittencourt MAV. Evaluation of facial proportions in the vertical plane to investigate the relationship between skeletal and tissue dimensions. *DPJO.*2011; 16 (1) : 99-106
- [16]. Migotuwio N. Desain grafis kemarin, kini, nanti. Lampung: penerbit; 2020. Hal 5-11
- [17]. Limbong, Tonni, and Janner Simarmata. *Media dan Multimedia Pembelajaran: Teori & Praktik.* Yayasan Kita Menulis, 2017: 19-37
- [18]. Hassan B, Greven M, Wismeijer D. Integrating 3D facial scanning in a digital workflow to CAD/CAM design and fabricate complete dentures for immediate total mouth rehabilitation. *J Adv Prosthodont.* 2017;9(5):381-6.