Cephalometric analysis for accurately determining the vertical dimension (case report)

CrossMark

Wahipa Wiro,* Ike D. Habar

Abstract

Objective: Determination of the vertical dimension of occlusion (DVO) tends to changes throughout the human life. The vertical dimension is determined by the interocclusal point of the upper and lower teeth contact so the application is limited when the natural teeth were missing.

Methods: A 50 year old female patient, partially edentulous on the upper and lower jaw with the remaining teeth were 12 (residual root), 11, 21, 23, 33 and 43. The remaining teeth were endodontically treated prior the complete denture procedure. Cephalometric photo was done in patients after making bite rim, upper and lower bite rim were given metal marker, the image was traced, then measured between metal to get the vertical dimension of occlusion.

Results: Many functional and aesthetic changes are occurred in the whole orofacial region and stomatognathic system. DVO is one of the difficult stages in prosthodontic treatment. Most of the techniques to determine DVO in edentulous patients are based on the soft tissue references, which can cause the different measurements. Cephalometric analysis allows the evaluation of bone growth changes and can be used as a diagnostic tool in prosthodontics to evaluate the results of prosthodontic rehabilitation.

Conclusion: Tooth loss without replacement may cause alteration of vertical dimension. Measurement of VD is one of important step in making denture.

Keywords: Cephalometric, Determining the vertical dimension

Cite this Article: Wiro W, Habar ID. 2017. Cephalometric analysis for accurately determining the vertical dimension (case report). *Journal of Dentomaxillofacial Science* 2(1): 41-44. DOI: [10.15562/jdmfs.v2i1.458](https://doi.org/10.15562/jdmfs.v2i1.458)

Department of Prosthodontic,
Faculty of Dentistry, Hasanuddin
University, Makassar, Indonesia

Introduction

The relation of lower jaw and upper jaw can be seen in 2 directions for either in vertical or horizontal. Horizontal relation is a centric relation while vertical relation is vertical dimension (VD).¹

Tooth loss may cause the alteration of vertical dimension. This alteration occurs in hard and soft tissue of face and jaw region. Thus, there are many functional and aesthetical changes in all orofacial region and stomatognathic system. The exact determination of upper and lower jaw relation is important to be considered before determining the diagnosis or fabricating of the prosthodontic rehabilitation.^{2,3}

Vertical dimension is a relation determined by distance between upper and lower jaw, in specific condition such as occlusion, it is called occlusal vertical dimension (OVD), yet when resting it is called rest vertical dimension/physiology. Determination of OVD is determined by natural teeth when still exist in oral cavity and when occluded.⁴

Vertical dimension can be restored with a denture fabrication. The stage of VD determination has been an important step in a successful treatment of removable denture because it can influence the phonetics as well as its function. The failure in

determining VD will cause many kinds of aberration such as: temporomandibular joint disorder, muscular dysfunction, atrophy and trauma of soft tissue, disturbance in phonetic, aesthetic, swallowing and chewing and alveolar bone resorption.^{4,5} Method used in the stage of DVI/DVF measurement till now has not been able to produce the most exact of DVI/DVF prediction although we know that this stage is very important to obtain a good occlusion.⁶ There are many kinds of determination of VD measurement, such as two dots, Willis bite gauge, swallowing, phonetics, biting forces and tactile. Although many advancement in prosthodontic, particularly in technique and material, however there is no method that does not have any weakness in producing patient's OVD.⁷

There are many measurement techniques of VD expected to be able to produce an accurate measurement of VD, however apparently some errors in measurement are remain occurred.¹⁰ Continued error of measurement of VD may cause changes to the function and aesthetic of all orofacial region and stomatognathic system. Further, it will also increase the duration of treatment and will lead to a higher cost spent by the patient.

*Correspondence to: Wahipa Wiro, Department of Prosthodontic, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia
wahipadrg@yahoo.co.id

Received 30 June 2016
Revised 28 August 2016
Accepted 03 January 2017
Available online 01 April 2016

- Xi = Central point of ramus
- ANS = Anterior nasal spine
- Pm = mental protuberance

Figure 1 Points of cephalometric analysis Morais Caregnato CH, Ornaghi B. Determination of final occlusal vertical, dimension by cephalometric analysis.

Figure 2 Intraoral photograph

Figure 3 Cephalometric photograph without maxilla and mandibular bite rim, before and after tracing

Cephalometric analysis has been used as a measurement aid of VD and as a diagnosis in dentistry. Although it is generally used in orthodontic, the cephalometric in prosthodontic has also been widely used as an instrument to evaluate prosthodontic rehabilitation results. It is normally used to verify

the orientation of occlusal plane, spee curve, position, and incisal guidance of anterior teeth.⁸⁻¹²

Cephalometric photograph may help the measurement of VD thus it is possible to produce more accurate measurement of VD. Cephalometric analysis used in this case is a Ricketts analysis. Ricketts analysis is simple because it only uses 3 points: SNA, Pm and Xi points.¹¹

These were underlain authors to be interested in measuring VD with the aid of cephalometric photograph using Ricketts analysis. Additional costs can not be denied, however it may provide a more accurate and more satisfying measurement.

Purpose

The purpose of this study was to compare occlusal vertical dimension measurements between two-dot techniques and ricketts analysis using cephalometric photograph to get correct patient's VDO.

Case Report

A 50-year old female patient visited Dental Hospital, Department of Prosthodontic Hasanuddin University. She wanted to have denture, the patient had never worn any denture before, she felt difficult to eat and lacked of confidence because she lost many of her teeth. From intraoral examination there were partial edentulous of maxilla and mandibular, the teeth that lost were 17, 16, 15, 14, 13, 22, 24, 25, 26, 27, 37, 36, 35, 34, 32, 31, 41, 42, 44, 45, 46 and 47. The teeth that still exist are 12 (gangrene radix), 11, 21, 23, 33 and 43 with caries, extrusion, recession and lost of vertical dimension [figure 1](#).

In radiograph examination it seems that there is bone lost in edentulous region of maxilla and mandibula. 12 (gangrene radix), 11, 12 and 23 are embedded within bone in more than a third of apical and 33 and 43 in a third of apical.

Management of case

Treatment plan for this case was fabrication of maxilla and mandibular complete denture. Primary impression done by using stock tray and irreversible hydrocolloid for edentulous, then fabrication of diagnostic cast were done. From the diagnostic cast, the custom tray was made. Pre-prosthetic treatment was endodontic treatment for the teeth that still exist. After endodontic treatment, the preparation of teeth crown and root canal with minimal depth of 3 mm were done to fabricate the coping. After the insertion of coping, cephalometric was taken, the result of this photograph was traced to measure vertical dimension of patient.

Individual tray was evaluated and adjusted in patient's mouth then border molding was done by using low fusing compound (green stick compound)

Figure 4 Occlusal plane photograph/orientation

Figure 5 Cephalometric photograph with Ricketts analysis using maxilla and mandibular bite rim, before and after tracing

in all margins, both in upper and lower jaw. Secondary impression was fabricated by using polyvinyl siloxane of elastomer after border molding. After obtained the precise impression, result of secondary impression was then casted with stone to gain master cast. On the master cast, the base plate and bite rim made of baseplate wax were made. The base must attach precisely to master cast and bite rim must suit to arch. The height of base and bite rim of upper and lower jaw must be based on glabella-subnasion guidance = subnasion-gnation = pupil-mouth corners. Base and bite rim of upper and lower jaw were tried in patient. Evaluation of the base stabilization was done by evaluating the thickness and the density of upper and lower base. The next step was the determination of orientation/ occlusal plane by adjusting the lower bite rim to upper bite rim. Adjusted the anterior part with pupil line and posterior part with champer line which pass through ala nasi to tragus/ porion with fox bite gauge. When adjustment, it is important to pay attention at the low

mouth thus coincided closely with base and bite rim lip line and labial fullness. The base and bite rim of lower jaw were adjusted inside patient's of upper jaw when occluded. Then, measurement of vertical dimension was done.

The measurement of vertical dimension in this case was started by measuring rest vertical dimension without bite rim of upper and lower jaw. The result of rest vertical dimension measurement was then reduced with free way space (2-3 mm) thus the measurement of occlusal vertical dimension was obtained. Bite rim of upper and lower jaw inserted to patient's mouth then adjusted with the result of occlusal vertical dimension which has been measured before, lower bite rim might be reduced, until determined occlusal vertical dimension was obtained. Determination of centric relation, fixation of bite rim of upper and lower jaw were done by using heated-paper clip. Before cephalometric photo, measurement of vertical dimension was done using two dots technique.

Cephalometric photograph was taken to measure occlusal vertical dimension by marking with paper clip mark on the base, the result of photograph were traced and measurement of occlusal vertical dimension according to Ricketts analysis were done.

If the desired angle has not been obtained, then it was possible to add or reduce the bite rim of lower jaw thus predetermined angle according to Ricketts analysis could be obtained. The next step was fabrication of complete denture once it was completed the next step was insertion of complete denture. Follow up was in 24 hours and 7 days after insertion of upper and lower complete denture.

Discussion

Lost/alteration of vertical dimension in this case was due to the patient lost many of her teeth and never replace it. The patient complained about difficulty in eating and speaking and she is not confident. Lost of natural teeth leads to lost of occlusal plane, vertical dimension (VD) and occlusion. To restore these functions it need to make complete denture with accurate measurement of vertical dimension.

Some methods in measurement of vertical dimension had been widely used, however there is still no appropriate method in measuring vertical dimension. Some studies used cephalometric photograph in measuring vertical dimension as well as restoring vertical dimension.^{10,12}

Occlusal vertical dimension in this case measured by using cephalometric photograph based on Ricketts analysis. Cephalometric photograph taken without bite rim, afterwards traced and measured the angle according to Ricketts analysis with ANS, Po and Xi points which obtained 40°.

After measurement of DVI, occlusal plane and vertical dimension were determined, then cephalometric photograph was taken with bite rim which was marked with metal inside patient's mouth. The result of cephalometric photograph is traced, that is 47°. If after tracing the result is more than 47°, reduce the height of mandibular bite rim. In contrary, if it is lower than 47°, increase the height of mandibular bite rim until the result of occlusal vertical dimension measurement is obtained.

The angle of 47° is an ideal angle to obtain occlusal vertical dimension.¹¹ Practice, there are still many errors in determination of OVD measurement thus the OVD may be higher or lower than the correct OVD. The OVD which is higher causes trauma to support tissues. Phonetic problems occur because of difficulty to occlude the teeth. When tooth is occluded it will produce sound (horse sound). It is not convenient to use and mastication muscles will be hurt (masseter), which may be taken as a sign. The aesthetic becomes bad because facial muscles becomes tense such as orbicularis muscle and this persists can cause disturbance in temporomandibular joint.¹³

When OVD is low, the corners of mouth appear less of support. Efficiency in mastication and aesthetic will reduce due to less support of lip and cheek. Protrusion will be occurred from chin when occlude the jaws.¹⁴ Clinical signs which will be seen as follows: A. Interocclusal distance is increased, B. Efficiency of mastication is reduced.⁷ Costen syndrome is occurred such as: A. light deaf, dizzy, tinnitus, painful when the joint is moved and pressed. B. Neurological signs will occurred: it feels like burn in tongue, throat, temporal region of head and disorder on saliva glands, thus secretion of saliva is reduced and mouth dry.³ Aesthetical signs that occur: A. A third of face will be shorter, B. Lip commissure is wider than usual, C. Face expression seems older.¹⁵

Continued error of measurement of VD, beside being able to cause changes in the function and aesthetic of all orofacial region and stomatognathic system, duration of treatment will increase thus it is being longer, this will cause the greater cost to be paid by the patient and sometimes it will make patient feels bored with multiple visits.

The addition of cephalometric photograph using Ricketts analysis provided a more accurate result in measurement of VD by obtaining a stable and retentive maxilla and mandibula complete denture, thus it can be used to fulfill better functions of mastication, speaking and aesthetic.

Conclusion

Tooth loss without replacement may cause alteration of vertical dimension. Measurement of VD is one of

important step in making denture. Continued errors in measurements of OVD may cause changes in the function and aesthetic of all orofacial region as well as stomatognathic system, thus duration and cost of treatment will increase. OVD measurements with the aid of cephalometric photograph using Ricketts analysis provides a more accurate result, thus it can be used in prosthodontic rehabilitation of cases with loss of VD. By using ricketts analysis we can restore previous patient's VDO. To make complete denture or removable denture which have lost VDO, we as prosthodontic specialist should using two dot technique to get VDO which be adapted with ricketts' analysis.

Conflict of Interest

The authors report no conflict of interest

References

1. Phoenix RD, Cagna DR, DeFreest CF. Stewart's clinical removable partial prosthodontics. 3rd ed. Chicago: Quintessence; 2003. p. 367-370.
2. Delic Z, Soskic MS, Grzic RP, et al. Evaluation of cranio-metric methods for determination of vertical dimension of occlusion. Coll Antropol 2000;1: 31-35.
3. Strajnic L, Sinobad DS, Marcovic D, et al. Cephalometric indicators of the vertical dimension of occlusion. Coll Antropol 2008;2: 535-541.
4. Zarb GA, Bolender CL, Hickey JC. Buku ajar prostodonsi untuk pasien tak bergigi menurut Boucher. Jakarta: EGC; 1990. p. 214-239.
5. Rikmasari R. Pengukuran antropometrik bagian tengah dan bawah muka untuk menentukan dimensi vertikal. Bandung: FKG UNPAD; 1999. p. 1.
6. Toolson LB, Smith DE. Clinical measurement and evaluation of vertical dimension. J Prosthet Dent 2006.
7. Mehta JD, Joglekar AP. Vertikal jaw relation as a factor in partial dentures. J Prosthet Dent 1969;2: 618-625.
8. Wirahadikusumah A. Analisis foto digital untuk memprediksi dimensi vertikal fisiologis FKG UI. Jakarta; 2012. p. 2.
9. Tuncay OC, Thomson S, Abadi B, et al. Cephalometric evaluation of the changes in patients wearing complete dentures. A 10-year longitudinal study. J Prosthet Dent 1984;51: 169-180.
10. Basker RM, Davenport JC. Prosthetic treatment of edentulous patients. Copenhagen: Blackwell Munksgaard; 2002. p. 172-176.
11. Caregnato MCH, Ornaghi B, Paula A, et al. Determination of final occlusal vertical dimension by cephalometric analysis. RSBO 2015;12: 143-150.
12. Ciftci Y, Kocadereli I, Canay S, et al. Cephalometric Evaluation of Maxillomandibular Relationships in Patients Wearing Complete Dentures: A Pilot Study. Angle Orthod 2005;75: 821-825.
13. Itjingsih WH. Geligi tiruan lengkap lepas. Jakarta: EGC; 1996. p. 69.
14. Beckket LS. Accurate occlusal relations in partial denture construction. J Prosthet Dent 1954;4: 487-495.
15. Sharry JJ. Complete denture Prosthodontic. 3rd ed. New York: McGraw Hill Book; 1974. p. 211.

This work is licensed under a Creative Commons Attribution