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Reproducibility of the vertical dimension by different educational degrees

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Abstract

Background: The establishment of the correct vertical rest position is considered essential, because this position is a critical landmark in determining the vertical relation of occlusion. Unfortunately, the physiologic rest position is variable as it may be influenced by muscle tension, fatigue, and properioception. A study was therefore, undertaken to investigate the repeatability of vertical dimension measurement by different education degree groups.

Materials and methods: thirty patients were investigated for vertical dimension measurement by different education degree groups (5^{th} class undergraduate students, house officers dentists, MSc and PhD), depending on a very popular and simple method by using millimeter ruler.

Result: the result showed that the difference in the vertical dimension measurements by the four different education degree groups was clinically not significant.

Conclusion:

1. The vertical dimension measurements obtained from the undergraduates and house officer dentists were dependable.
2. The time-span of the measuring procedure has no effect on the determination of the vertical dimension throughout a single visit.
3. The caliper method was practical, simple and accurate in academic work. As The result of this study reveals the reproducibility of this method by all of the investigators.

Keywords: Vertical dimension, complete denture, educational degrees.

Introduction

The determination of correct vertical dimension (VD) an important procedure in the treatment of the edentulous patient[1,2,3, 4].the vertical dimension is the length of the face as determined by the amount of the separation of the jaws. There are two vertical dimensions, one is the length of the face when the teeth are in contact and the mandible is in centric relation called occlusal vertical dimension (OVD) and the other is the length of the face when the teeth are separated and the mandible is in a physiologic rest position called vertical dimension of rest (RVD)[2].

According to the glossary of prosthodontic terms (2005), the physiologic rest position is defined as: "position assumed when the head is in an upright position and the involved muscles, particularly the elevator and depressor groups, are in equilibrium in tonic contraction, and the condyles are in a neutral, unstrained position"[5].

The establishment of the correct vertical rest position is considered essential, because this position is a critical land mark in determining the vertical relation of occlusion [4,6].

Many methods have been advocated for the measurement of RVD, these include facial measurements, pre-extraction records, swallowing methods, biting force measurements, phonetic methods, esthetic, tactile methods, cephalometric and electromyography [1-2,3,4,7,8,9-10-11]

However, there is no single precise scientific method for determining the correct (VD) for the edentulous patient[1,2,3,4,8], so a combination of some of the above methods will simplified the clinical determination of the RVD [4, 7]. Unfortunately, the physiologic rest position is variable as it may be influenced by muscle tension, fatigue and properioception [12].

Many factors have been suggested as responsible for the ambiguities associated with (YD) measurements and calculations, which include difficulties in obtaining measurements on the skin of the face and the range of variability in physiologic and pathologic states [11][13].

The aim of this study was to study the reproducibility of vertical dimension measurement by different education degrees by using a conventional, popular and simple method of measurement used in dental clinic.

Materials and methods

Thirty patients (15 males and 15 females) with ages ranging from (49-81) years attending to prosthodontic department in Baghdad University whom met the following requirements were selected: [class I edentulous alveolar ridges, normal straight profile, no history of TMJ pathology or dysfunction, no denture wearing experience and no extra oral or intra oral pathology].

A group of dentists consisting of four different educational degrees: 5th year B.D.S undergraduate students, house officers dentists graduated for the last 2-4 years, MSc and PhD graduates in prosthodontic department in Baghdad University participated in this study by measuring the RVD and OVD at the time of delivery of complete denture construction, by using the caliper method, using a millimeter ruler depending on the hypothesis that the caliper method is more accurate, simple, practical, less expensive and most popular method in clinical practice [1,7,8]. Every investigator received a leaflet with instructions for a standard method of establishing a patient's physiologic rest position included a combination of relaxation, phonetics and facial appearance methods resulting in a position of comfort with lips lightly touching as recommended in the literatures.

The patients were positioned in the dental chair in a fully upright position, with the back of the patient in maximal contact with back of the chair. A head rest supported the head with the ala-tragus line in a horizontal position parallel to the floor [1]. This position was maintained throughout the recording procedure .

Since the chin-nose distance method is influenced by compression of soft tissue in the region of the skin markers [1, 13],two measuring points were marked by using indelible pencil one related to the upper arch in the canine fossa and one related to the lateral aspect of the chin. These points must be on sites of minimal influence from the muscles of facial expression, to avoid skin movement, and should be chosen only after careful observation of the patient seated normally in the dental chair with the head erect. To obtain the vertical dimension of rest, the distance between these two points was measured using millimeter ruler, the measurement was made with the patient in a relaxed and comfortable position without upper and lower denture in the patient mouth, the patient was asked to swallow, to wet his lips with his tongue, and to be perfectly relaxed. Then, to obtain the vertical dimension of occlusion, the upper and lower dentures were inserted, and the subject was asked to close in centric occlusion. The distance between the two measuring points were measured. All the readings were recorded first in the morning to avoid any possibility of muscle fatigue effect on the physiological rest position.

All the (VD) measurements were made in sequence for the same patient starting by the 5th year undergraduate students followed by the house officer dentists, then the MSc and finally the PhD examiners.

All the measuring procedure takes 35 minutes," Each investigator expends 5 minutes for (RVD) when the patient was induced to relax without dentures and again (OVD) measurement when the patient closed in centric occlusion with teeth in contact, followed by 5-minute rest for the patient.

Results

Tables (1) and (2) were shown the mean and standard deviation of the (VDO & VDR) measurements in millimeters by the different examiners. Each (VDR & VDO) reading was obtained by calculating the mean of 5 readings.

The statistical significance of difference in (VDR & VDO) mean between the 4 educational degree groups was assessed by one way (ANOVA) test (tables 3 & 4). The test applied separately for (VDR & VDO). The result showed that there was no significant difference in (VDR & VDO) mean for all the patients between the 4 education degree group ($P>0.05$).

To test the significance of difference between each pair of education degree group, the multiple comparisons test was applied by using the L.S.D. (Least Significance Difference) for the (VDR & VDO) variables. The results also showed that there was no significant difference in the mean (VDR & VDO) between each 2 education degree group (tables 5 & 6).

Discussion

It is interesting to note that there was clinically no significant difference in (VD) measurement between the undergraduate students and the House officers dentists which have a less theoretical and clinical skill in vertical dimension measurement than the MSc and PhD groups which they have definitely a more skill and clinical experience. This may be attributed to that all the investigators in this study learned in the same school (Baghdad University). So, the theoretical and clinical experience transmitted to all of the educational degree groups generation after generation.

Although the physiologic rest position is variable as it may be influenced by muscle tension, fatigue and properioception [12], the result of this study reveals that these factors (tension and fatigue) have no effect on the frequent vertical dimension measurement ($P>0.05$). This may be due to the frequent visits and attendance of the patients to the dental clinic (the measurement was taken in the insertion step), which may exclude the fear and tension action. Also, the time of the recording procedure lasts only 35 minutes, which was not a long time that would affect on the muscles of mastication and probably cause muscle fatigue or relaxation.

The most common and simple method to record and check the vertical dimension in the academic dental clinic is the caliper method or called direct measurement method (by using a millimeter ruler)[I> 8].The result of this study reflects the reproducibility of the vertical dimension record by different education degree, which has been the primary means of judging the accuracy of this method.

From the result of this study, the short time-span of the measuring procedure has no effect in determining the vertical dimension. As that, each investigator measured the (VD) subsequently expending 35 minutes. This finding agrees with the finding of Shepard & Shepard [11> 14] as they found that the difference between the original the subsequent measurements was not statistically significant and disagrees with the finding of Garnick & Ramfjord [15] as they demonstrated a variation in the rest position from the start to the finish of their experimental period. This may be attributed to that the time lasted in this study was only 35 minutes, which was a very short time to produce a wide variation in the physical characteristics of the patients, which may lead to muscle tension or fatigue that's affecting the (VD) measurement.

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Table (1) - Mean & Standard Deviation of RVD in millimeters by different examiners.

95% Confidence Interval for Mean								
Examiners	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
1.00	30	44.4000	5.5295	1 .0096	42.3352	46.4648	31.00	55.00
2.00	30	44.5500	5.5185	1.0075	42.4893	46.6107	32.00	53.00
3.00	30	44.9167	5.2737	.9628	42.9474	46.8859	32.00	54.00
4.00	30	45.8167	5.4417	.9935	43.7847	47.8486	32.00	55.00
Total	120	44.9208	5.4011	.4931	43.9445	45.8971	31.00	55.00

Table (2) - Mean & Standard Deviation of OVD in millimeters by different examiners.

95% Confidence Interval for Mean								
Examiners	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
1.00	30	42.2667	5.6519	1.0319	40.1562	44.3771	30.00	51.00
2.00	30	42.3833	5.9039	1.0779	40.1788	44.5879	29.00	52.00
3.00	30	42.3333	5.6130	1.0248	40.2374	44.4293	30.00	52.00
4.00	30	42.6500	5.7613	1.0519	40.4987	44.8013	30.00	52.00
Total	120	42.4083	5.6628	.5169	41.3847	43.4319	29.00	52.00

Table (3) - ANOVA test shows the difference in RVD measurements between the four educational degree groups.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups Within Groups Total	36.340 3435.158 3471.498	3 116 119	12.113 29.613	.409	.747

Table (4) - ANOVA test shows the difference in OVD measurements between the four educational degree groups.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups Within Groups Total	2.542 3813.450 3815.992	3 116 119	.847 32.875	.026	.994

Table (5) - Multiple comparisons test shows the difference in the RVD means between each two educational degree groups.
LSD

(1) VAR00003 (J) VAR00003		Mean Difference d-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00 4.00	2.00 3.00	-.1500 - .5167 - 1.4167	1.4051 1.4051 1.4051	.915 .714 .315	-2.9329 - 3.2996 - 4.1996	2.6329 2.2663 1.3663
2.00 4.00	1.00 3.00	.1500 -.3667 -1 .2667	1.4051 1.4051 1.4051	.915 .795 .369	-2.6329 - 3.1496 - 4.0496	2.9329 2.4163 1.5163
3.00 4.00	1.00 2.00	.5167 .3667 -.9000	1.4051 1.4051 1.4051	.714 .795 .523	-2.2663 - 2.4163 - 3.6829	3.2996 3.1496 1.8829
4.00 3.00	1.00 2.00	1.4167 1.2667 .9000	1.4051 1.4051 1.4051	.315 .369 .523	-1.3663 - 1.5163 - 1.8829	4.1996 4.0496 3.6829

Table (6) - Multiple comparisons test shows the difference in the OVD means between each two educational degree groups.
LSD

(I) VAR00003 (J) VAR00003		Mean Difference d-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	-.1167	1.4804	.937	-3.0488	2.8155
3.00		-6.6667E-02	1.4804	.964	-2.9988	2.8655
4.00		-.3833	1.4804	.796	-3.3155	2.5488
2.00	1.00	.1167	1.4804	.937	-2.8155	3.0488
3.00		5.000E-02	1.4804	.973	-2.8822	2.9822
4.00		-.2667	1 .4804	.857	-3.1988	2.6655
3.00	1.00	6.667E-02	1.4804	.964	-2.8655	2.9988
2.00		-5.0000E-02	1.4804	.973	-2.9822	2.8822
4.00		-.3167	1.4804	.831	-3.2488	2.6155
4.00	1.00	.3833	1 .4804	.796	-2.5488	3.3155
2.00		.2667	1.4804	.857	-2.6655	3.1988
3.00		.3167	1 .4804	.831	-2.6155	3.2488

Table (5) - Multiple comparisons test shows the difference in the RVD means between each two educational degree groups.
LSD

J!) VAR00003	(J) VAR00003	Mean Difference d-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	-.1500	1.4051	.915	-2.9329	2.6329
	3.00	-.5167	1.4051	.714	-3.2996	2.2663
	4.00	-1.4167	1.4051	.315	-4.1996	1.3663
2.00	1.00	.1500	1.4051	.915	-2.6329	2.9329
	3.00	-.3667	1.4051	.795	-3.1496	2.4163
	4.00	-1.2667	1.4051	.369	-4.0496	1.5163
3.00	1.00	.5167	1.4051	.714	-2.2663	3.2996
	2.00	.3667	1.4051	.795	-2.4163	3.1496
	4.00	-.9000	1.4051	.523	-3.6829	1.8829
4.00	1.00	1.4167	1.4051	.315	-1.3663	4.1996
	2.00	1 .2667	1.4051	.369	-1.5163	4.0496
	3.00	.9000	1.4051	.523	-1.8829	3.6829

Table (6) - Multiple comparisons test shows the difference in the OVD means between each two educational degree groups.
LSD

(I) VAR00003	(J) VAR00003	Mean Difference d-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	-.1167	1 .4804	.937	-3.0488	2.8155
	3.00	-6.6667E-02	1.4804	.964	-2.9988	2.8655
	4.00	-.3833	1.4804	.796	-3.3155	2.5488
2.00	1.00	.1167	1 .4804	.937	-2.8155	3.0488
	3.00	5.000E-02	1.4804	.973	-2.8822	2.9822
	4.00	-.2667	1 .4804	.857	-3.1988	2.6655
3.00	1.00	6.667E-02	1 .4804	.964	-2.8655	2.9988
	2.00	-5.0000E-02	1.4804	.973	-2.9822	2.8822
	4.00	-.3167	1.4804	.831	-3.2488	2.6155
4.00	1.00	.3833	1 .4804	.796	-2.5488	3.3155
	2.00	.2667	1.4804	.857	-2.6655	3.1988
	3.00	.3167	1.4804	.831	-2.6155	3.2488

* 1.00 = Undergraduate Students
* 2.00 = House Officer Dentists
*3.00 = MSc group M.OO = PhD group