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## Clinical study to evaluate the duration of masticatory cycles after reducing the occlusal vertical dimension in edentulous patients

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### Abstract

Determining the Vertical Dimension of Occlusion (OVD) is an important step in fabricating complete dentures for edentulous patients. Studies indicate that the change in OVD affects the patient's biting force and may affect masticatory efficiency.

**Purpose:** The purpose of this study was to evaluate the duration of the masticatory cycles in complete denture wears after reducing the Occlusal vertical dimension.

**Materials and Methods:** Twenty completely edentulous subjects, 4 females and 16 males, their ages were between (40-70) years precipitated in this study. One upper and two lower complete dentures were fabricated for each subject, the first set of upper and lower complete dentures were made with a suitable OVD, while the second set of complete dentures were made with reduced OVD (about 3 mm). The Duration of twenty masticatory circle was performed two months after the patient delivered the first complete denture. The same procedures were repeated for the second set of complete denture wears.

**Results:** The mean of The Duration of twenty masticatory cycles in the patients who wear complete dentures with suitable OVD was 11.22 seconds, while for the patients who wear complete dentures with reduced OVD was 11.99 seconds.

**Conclusions:** The value of the Duration of twenty masticatory cycles in dentures with an appropriate OVD was smaller than that of the decreased OVD in the research sample. There are statistically significant differences in the mean of the Duration of twenty masticatory cycles between the two groups at the confidence level of 95%.

**Keywords:** Masticatory cycles, complete dentures, Occlusal Vertical Dimension (OVD)

### Introduction

Occlusal Vertical Dimension (OVD) is the distance measured between two points when the dental arches are in occlusion at maximum intercuspation [1]. Determination of the correct OVD for edentulous patients is one of the most important steps in making dentures with adequate esthetics and function [2]. According to Sharry [3] determining VDO is not a precise process, and many experts will come to this dimension using different methods. Different methods have been proposed for determining VDO [4-6] and many of them were used by various authors [5, 6] in edentulous people as well as in people with teeth.

All of these methods are inaccurate in determining the vertical occlusal dimension that may result in a plus or a low dimension.

A decreased OVD can lead to the appearance of lesions, such as angular cheilitis, facial disharmony, and temporomandibular disorders; meanwhile, an increased VDO may lead to the onset of joint and muscle pain, tension in functional speech, difficulty in swallowing, impaired chewing, tooth sensitivity due to traumatogenic forces, pathologic bone resorption, abnormal wearing of teeth, the appearance of an elongated face, and a facial expression of fatigue [7].

Many edentulous patients have adapted to a vertical dimension which has decreased due to bone resorption and posterior tooth wear. Restoring the proper vertical dimension is further complicated because the rest position may be subject to change. Swerdlow found that the vertical dimension of rest varies after natural tooth contacts are lost. Also, the rest vertical dimension can undergo a reduction comparable to the loss of occlusal vertical dimension [8]. McGee found that patients tend to register a reduced vertical dimension of occlusion because they feel more comfortable in this position [9].

Niswonger observed that the patients whose vertical dimension of occlusion was excessive complained that they could not use the dentures tissue change until an interocclusal for mastication because of continual soreness on the residual ridges. Trauma to the ridges of these patients caused continuous distance of 4/32 inch had been obtained. Not until this space had developed was the patient able to masticate food with satisfaction and comfort [10]. Tenth felt that nature may shorten muscles, but rarely, if ever, is their functional length increased. There are conflicting reports in the literature regarding the effects of decreasing the OVD. Some authors have suggested that the stomatognathic system naturally adapts to decreases in OVD, for example in cases of tooth loss or severe dental attrition. Conversely, other authors have suggested that a decrease in OVD can predispose the patient to TMD. Nevertheless, there is no strong evidence in the literature supporting either of these statements [11]. McGee found that patients tend to register a reduced vertical dimension of occlusion because they feel more comfortable in this position [9].

The loss of natural teeth leads to bone resorption, temporomandibular dysfunction, 8 and muscular hypotonicity, which may affect structures involved in mastication [12]. Furthermore, treatment success depends not only on management or preparation of the patient, but also on the clinical quality of the dentures [13-16]. Food is generally eaten in mouthfuls, and the processing of a mouthful has been reported to involve a mastication sequence of 10 to 40 chewing cycles [17, 18]. Some studies have reported findings in which subjects were generally represented by a point regarding age and number of cycles required to chew and swallow the model food with both natural dentition [19-22] and dentures [20-28]. Some researchers have reported that edentulous individuals, when provided with optimal complete dentures, presented with masticatory efficiency lower than in those with natural teeth.

The aim of this study was to assess the duration of the masticatory cycles in complete denture wears after reducing the Occlusal vertical dimension.

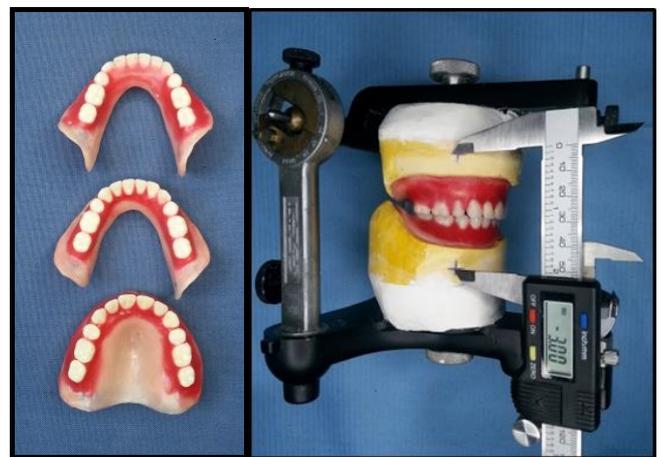
**Material and Methods**

Twenty completely edentulous subjects, 4 females and 16 males, their ages were between (40-70) years precipitated in this study. One upper and two lower complete dentures were fabricated for each subject, the first set of upper and lower complete dentures was made with a suitable OVD, while the second set of complete dentures were made with reduced OVD (about 3 mm), figure (1). The Duration of twenty masticatory cycles test was performed two months after the patient delivered the first complete denture. The same procedures were repeated for the second set of complete denture wears.

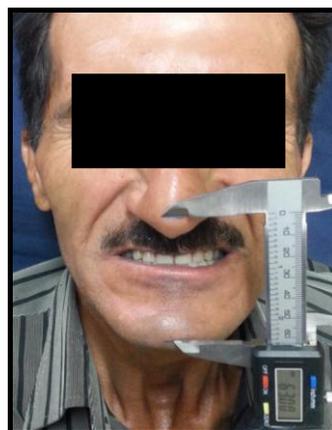
The maxillary cast of each patient was mounted in a semi adjustable articulator (Hanau H2) using a face bow (face bow

Hanau). OVD was established using the physiological rest positions associated with phonetic and esthetic techniques figure (2, 3) [29]. Centric relation was established according to dynamic records based on physiological movements of the jaws, including opening, closing, and lateral movements performed by the patient [29]. These records were performed to position the mandibular casts on the articulators. Artificial teeth were selected, and bilateral balanced occlusion was obtained [30]. The dentures were waxed, processed, finished, and polished for insertion and follow-up.

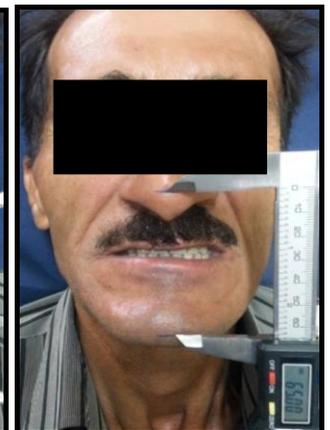
Mastication tests were performed using natural food. Each patient received an apiece of natural food (walnut) weighing a total of 3 g [31]. The food was chewed for 20 cycles, The patients were instructed to chew the natural food with slight movements and not to swallow the food. The number of cycles was determined to be close to the moment of natural swallowing figure (4). The cycles were monitored by an examiner and timed in seconds by a digital watch. Patients were allowed to select the chewing side.



**Fig 1:** Reducing the OVD by 3 mm at the premolars area in articulator



**Fig 2:** Suitable OVD



**Fig 3:** Reduced OVD



**Fig 4:** Duration of twenty masticatory cycles

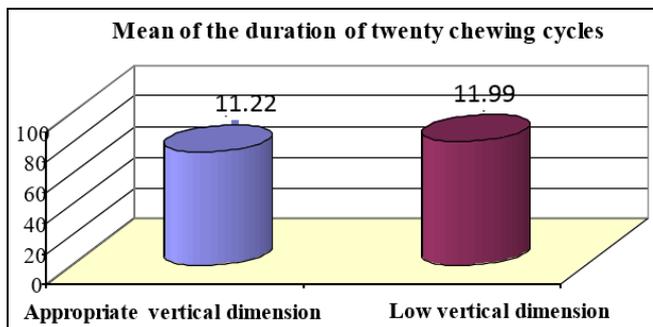
**Results**

The mean time required to perform 20 masticatory cycles was 11.22 seconds at patients with appropriate Occlusal vertical dimension. But the patients with decreased Occlusal vertical dimension was 11.99 seconds Table (1).

**Table 1:** The mean time required to perform 20 masticatory cycles

Duration of 20 masticatory cycles		patient
low	appropriate	
13.395	12.97	1
11.85	11.78	2
12.5	10.085	3
12.5	9.14	4
10.445	11.85	5
12.755	12.44	6
13.06	12.71	7
12.925	12.92	8
14.57	13.66	9
13.36	12.955	10
14.1	12.4	11
10.325	9.14	12
12.5	11.65	13
10.93	10.085	14
10.17	9.645	15
11.755	11.64	16
12.76	12.095	17
9.495	8.94	18
9.88	9.175	19
10.525	9.17	20
11.99	11.2225	Mean

**Statistical study:** Independent *t* test was Conducted to compare the differences in the Duration of the twenty masticatory cycles, between the two studied conditions (the appropriate OVD and the low OVD in the research.



**Chart 1:** Represents the mean of The Duration of twenty masticatory cycles in the research sample according to the condition studied.

**Table 2:** Independent t test results

The duration of 20 chewing cycles (in seconds)			
significance of differences	significance level	t	difference between two mediums
There are no significant differences	0.124	1.572	0.77

By conventional criteria, this difference is not considered to be statistically significant.

**Discussion**

In this study, There are statistically significant differences in the mean of the Duration of twenty masticatory cycles between the two groups Tables(2), chart (1), independent *t*

test was used, table (2), The value of the Duration of twenty masticatory cycles in dentures with reduced OVD was longer than that of the suitable OVD in the research sample. This could lead to greater chewing of food [17, 18], as well as the complex neuromuscular skills required to overcome the limitations of dentures.

Patients with reduced OVD showed a longer time to complete twenty chewing cycles. This can be explained by the fact that chewing the food required more time due to increase of the inter occlusal space. The dentures with suitable OVD perhaps required a lower amount of force to chew the food and small time to perform 20 mastication cycles [28]. These results are consistent with the study of Fouda, S.M., *et al.* [32, 33], values vary from one patient to another, it may be due to the different of muscular capacity and ability in complete denture wears [25].

In the present study, the reduction in the number of cycles occurred mainly at the end of mastication. The reduction of cycles in this specific chewing period may have occurred due to a greater capacity of patients to chew food with suitable OVD.

**Conclusion**

Within the limits of this study. The value of the Duration of twenty masticatory cycles in dentures with reduced OVD was longer than that of the suitable OVD in the research sample. There are statistically significant differences in the mean of the Duration of twenty masticatory cycles required to chew the test between the two groups at the confidence level of 95%.

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