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ORIGINAL ARTICLE

A COMPARATIVE EVALUATION OF DIFFERENT METHODS OF ESTIMATING VERTICAL DIMENSION OF OCCLUSION BASED ON CLINICAL PERCEPTION OF PATIENTS- AN IN VIVO STUDY

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***ABSTRACT*:**
Statement of problem: The recording of vertical jaw relation in the treatment of edentulous patients aim at facilitating the adaptation of complete dentures to the masticatory system to give them an optimal and comfortable function. There are various techniques described in the literature to record vertical jaw relation, but there is a need to intercompare these methods based on patient's acceptance. **Aim:** To determine the efficiency of different method to establish vertical dimension at occlusion comparing three conventional methods and analyzing patients acceptance of these respective methods**. Methodology: ten completely edentulous subjects, each of three groups** which includes methods **to record** vertical jaw relations (physiological method, phonetics and swallowing threshold) on patients between age group of 45-60 years were selected for the study. Vertical dimension at rest and at occlusion were determined by operator1(OP1-prosthodontist. After each recording, operator-2 (OP-2 patient &, or person accompanying patient) was asked about the appearance, which one was better to look at, and the comfort and this clinical acceptance was recorded on a scale from 1 to 3 by both Operator and the patient. *Student's paired t-test* was used to know whether there was any statistically significant difference between two independent sample means with Significance tested at 1% level of confidence ($p<0.01$). **Results:** It can be concluded from the study that, statistically the mean values of swallowing threshold (OP I – 1.5000, OP II – 2.200) significant compared to the values of physiologic rest position (OP I – 2.90, OP II – 2.84) and phonetic method (OP I –1.80, OP II –2.51). **Conclusion:** Swallowing threshold was acceptable to both operator and the patient, as statistical significant difference was found with the vertical dimension values obtained by other two methods. Therefore it is suggested that swallowing threshold method may be employed for establishing vertical dimensions, however other two methods must be used for evaluation of vertical dimension and interocclusal distance.
Keywords: freeway space, vertical dimension at rest, vertical dimension at occlusion.

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INTRODUCTION:

Rehabilitation of edentulous state is no big issue with the advent of advancement in material science and technology. Irrespective of the treatment options selected in restoring the lost tooth in an edentulous state, estimation and restoring the lost facial height is a very critical step. Vertical dimension affects the facial esthetics, function and comfort of the stomatognathic system to a major extent. There is tremendous data available in the literature, reviewing various techniques in determining vertical dimension at rest and at occlusion[1,2]. Irrespective of the method used, recording of vertical jaw relation in the treatment of edentulous patients should always aim at facilitating the adaptation of complete dentures to the masticatory system to give them an optimal and comfortable function. Some of the popular methods to establish vertical dimension of occlusion used in the dental practice are physiologic method, esthetics and phonetics etc. Though these methods are extensively well practiced, there is a need to intercompare these methods based on the subjective symptoms and clinical acceptance. There is a need to investigate how far are these methods are comfortable and accepted by the patient. Hence, this study was conducted to intercompare various methods to establish vertical dimension of occlusion based on the clinical perception. This study was to determine the efficiency of three different commonly practiced methods to establish vertical dimension at occlusion based on operators and patients acceptance .

MATERIAL AND METHODOLOGY:

The study was conducted in the Department of Prosthodontics, S.D.M. College of Dental Sciences, Dharwad. Prior to the start of the study, the study protocol

was submitted to S.D.M dental college and hospital ethical committee named SDMCDSH-IEC ETHICS COMMITTEE and the ethical clearance was obtained for the present study.

The study was to compare the three different methods to record vertical dimension of occlusion based on the acceptance of patients. For such clinical evaluation, a group of screened edentulous population was informed about the purpose and procedure involved in the study. After seeking their consent to participate in the study, a total of 64 edentulous patients from SDM Dental College and Hospital, Dharwad were screened and 10 edentulous subjects were selected. These were the test subjects for the study.

The Criteria used for Case Selection were;

- Completely edentulous patients (45-75 years)
- Absence of local/ systemic diseases
- Normognathic relationship
- Firm, resilient ridge mucosa with average to good edentulous foundations.

Among the 64 screened patients, 10 edentulous subjects were selected for the study. Primary impressions were made using medium fusing impression compound (picture-1) and impressions were poured using dental plaster. Custom trays were fabricated on the primary cast. Border moulding was done using low fusing compound and final impressions were made with Zinc oxide eugenol impression paste (picture-2). Master impressions were poured in dental stone.

Recording jaw relation:

The anterior level of maxillary occlusal rim was adjusted according to patients esthetics and Phonetics. Anterior plane is established parallel to the interpupillary line and posterior pane is made parallel to the campers plane. Plane of mandibular rim was adjusted accordingly.

The vertical dimension of occlusion in this study was determined by 3 different methods:

1. Physiologic rest position method
2. Phonetics method
3. Swallowing threshold method

Physiologic rest position method:

After the insertion of occlusal rim into the patients mouth, patient was asked to swallow and relax. The vertical dimension at rest and at occlusion was measured by indelible dots on the face. The distance between the two points is measured. The procedure is repeated again to recheck the measurement until the two measurements coincide. This is the rest vertical dimension. The occlusal rims are then adjusted such that they occlude in the mouth and the distance between these points is less than 3m than the first meaurement to allow the desired freeway space between the rims. Lips were carefully parted to check for amount of space present between the occlusal rims. Thus, 2-3mm of interocclusal rest space was established between the maxillary and mandibular occlusal rims. (picture-3).

Phonetic method:

This theory is dependent upon a correlation during speech of the interocclusal distances, the position of the occlusal plane, and the position of the tongue relative to the occlusion rims or teeth. Production of certain sounds like "S, J, CH, SIXTYSIX" brings the anterior teeth very close together. When correctly placed, the lower incisors are moved forward to a position nearly under the upper central incisors almost touching them. Patient was asked to repeat the number "THIRTY THREE", which helps to evaluate if there is enough space for the tip of tongue to protrude between the anterior teeth. Maxillary occlusal rim was placed in the patient's mouth and adjusted to provide proper lip support. Height of the lower occlusal rim was adjusted until a minimum of 2mm space exists when the patient pronounces "S". Thus, vertical dimension was measured when the mandible & muscles involved are in physiologic function of speech.(picture-4)

Swallowing threshold method:

The mandibular pattern of movement during deglutition is the same for the edentulous infant as it is for the edentulous adult. The eruption of teeth is held at the occlusal plane by the act of swallowing which establishes the VDO. As the person swallows, the teeth come together with a very light contact at the beginning of the swallowing cycle. 3 cones of soft wax were built on the mandibular wax rim. The patient was instructed to swallow his saliva several times and repeated action of swallowing gradually reduced the height of wax cones to allow the mandible to reach the level of natural centric occlusal position. (picture-5).

Thus vertical dimension at rest and at occlusion were established and recorded for 10 subjects using 3 different methods (physiologic rest position method, phonetics method, swallowing threshold method).

Picture-1: Primary impressions

Picture-2: Final impressions

Picture-3: Vertical dimension with physiologic method

Picture-4: Phonetic method

Picture-5: swallowing threshold method.

Evaluation of acceptance:

Using three different methods vertical dimension at rest and at occlusion, were determined and measured for 10 patients. After each recording, the OP-2 (patient &,or person accompanying patient) was asked about the appearance, which one was better to look at, and the comfort and this clinical acceptance was recorded on a scale from 1 to 3 by both Operator (OP-1)and the patient (OP-2).

Student's paired t-test was used to know whether there was any statistically significant difference between two independent sample means.

RESULTS:

Abbreviations used in the tables

- M1: Physiologic rest position method.
- M2: Phonetic method.
- M3: Swallowing threshold method.
- OP 1: Operator one.
- OP2: Operator two.
- IO: Interocclusal distance.
- Mean: Mean values.
- S.D: Standard deviation.
- /t/ : Absolute value of t.
- P-value: Probability.
- N.S: Not significant (p >0.05)
- S: Significant at 1% level of confidence (p<0.01)

Three different methods were used to determine vertical dimension at rest and at occlusion, were determined for edentulous 10 patients. The vertical dimensionat rest and occlusion of every patient was measured using three different methods (physiologic rest method, phonetics and swallowing threshold method). After each method of determining and measuring vertical dimension, the OP-2 was asked about the appearance, which one was better to look at, and more comfortable and clinically acceptable. Opinion was recorded on a scale from 1 to 3 by both

Operator (OP-1)and the patient (OP-2) (Table-1,2). Scale measured 1-average acceptance, 2-normal, 3-satisfactory. Among the three methods, swallowing threshold showed the highest score followed by physiologic rest method and then the phonetic methods. Thus, swallowing threshold method was the most satisfying to OP-2.

Table-1 : scores obtained pertaining to the method of recording vertical jaw relation level of satisfaction about acceptance by the patient

Case no:	Physiologic rest position method	Phonetic method	Swallowing threshold method
1.	2	2	3
2.	2	1	3
3.	3	2	2
4.	2	1	3
5.	3	2	3
6.	2	1	3
7.	3	1	2
8.	3	2	2
9.	2	2	3
10.	3	2	2

Table -2 scores obtained pertaining to the method of recording vertical jaw relation level of satisfaction about acceptance by the patient

Physiologic rest position method			Phonetic method			Swallowing threshold method		
Preference Score	No. of patients	Percentage of patients	Score	No. of patients	Percentage of patients	Score	No. of patients	Percentage of patients
1	01	10%	**1**	03	30%	**1**	01	10%
2	06	60%	**2**	06	60%	**2**	02	20%
3	03	30%	**3**	01	10%	**3**	07	70%

In the present study when the records of vertical dimension of face made by operator 1 and operator 2 were compared, have shown no significant difference with |t| value as 0.1793 at P- value of 0.8596, with physiologic rest position method. 0.1mm (mean difference) in interocclusal distance.

Table-3 Statistical analysis (Student's' test) of means of interocclusal distance measured by different methods for all patients

GROUP NAME	MEAN	S.D	ItI- value	P value	Remark
M1 IO OP1	2.9000	0.8756	3.2205	0.0047	S
M2 IO OP1	1.8000	0.6325			
M1 IO OP1	2.9000	0.8756	4.3320	0.0004	S
M3 IO OP1	1.5000	0.5270			
M2 IO OP1	1.8000	0.6325	1.1523	0.2643	NS
M3 IO OP1	1.5000	0.5270			
GROUP NAME	**MEAN**	**S.D**	**ItI- value**	**P value**	**Remark**
M1 IO OP2	2.8400	0.5929	1.2137	0.2405	S
M2 IO OP2	2.5100	0.6226			
M1 IO OP2	2.8400	0.5929	2.4376	0.0254	S
M3 IO OP2	2.2000	0.5812			
M2 IO OP2	2.5100	0.6226	1.1510	0.2648	NS
M3 IO OP2	2.2000	0.5812			

With the inter comparison of different methods by operators it was statistically analysed that vertical dimension measurements were highly significant for phonetic method with |t| value of 2.5298 at P value of 0.0210 and swallowing threshold |t| value of 2.8214 at P value of 0.0113 with mean difference of 0.7mm each respectively. The vertical dimension measurements made by physiologic rest position method and phonetic method were compared have shown highly significant difference with operator-1 with |t|-value 3.2205 at P value of 0.0047 With mean difference of 1.1mm interocclusal distance (Table-3,4)

Table-4 Statistical analysis (Students 't' test) of means of interocclusal distance measured by different methods for all patients

Group name	Mean	S.D	| t| value	P-value	remark
M1 IO OP1	2.9000	0.8756	0.1794	0.8596	NS
M1 IO OP2	2.8400	0.5929			
M2 IO OP1	1.8000	0.6325	2.5298	0.0210	S
M2 IO OP2	2.5100	0.6226			
M3 IOOP1	1.5000	0.5270	2.8214	0.0113	S
M3 IO OP2	2.2000	0.5812			

The vertical dimension measurements made by physiologic rest position method and swallowing threshold method were compared. There has been a significant difference with operator-1 with |t|-value as 4.332 at P value of 0.0004 and operator-2 with |t| as 2.43 at P value of 0.0204 with mean difference of 1.4mm and 0.6mm respectively in interocclusal distance.

The vertical dimension made by phonetic method and swallowing threshold method were compared and it showed no significant difference with operator-1 with |t|-value of 1.1523 at P-value of 0.2643, and operator-2 with |t|-value of 1.1510 at P-value of 0.2648 with mean difference of 0.3mm each Interocclusal distance.

DISCUSSION:

Recording the jaw relation in an edentulous state is the most challenging step in the fabrication of complete denture. Due to the difficulty in establishing the correct VDO (vertical dimension of occlusion) for edentulous patients, many researchers developed different techniques based on muscular posture positions [3,4,5] ,facial esthetics [6], oral function [7,8]. The most used techniques for the VDO determination are those recommended by Niswonger (1934) and by Silverman (1952) [4,8]. Based on clinical observations, Niswonger noticed that from the postural vertical dimension (PVD), the distance between the bases of the mentum and the nose while swallowing was 3.16 mm, ranging from 0.79 to 8.69 mm [4]. Thereby, for VDO determination it would be necessary to obtain the patient's PVD and subtract the distance determined by Niswonger, named as freeway space (FS). Moreover, a phonetic method was established by Silverman, who verified that the position of the mandible during the pronunciation of sibilant sounds coincide with the OVD position, determining then a physiological method to obtain the VDO.

The present study compared three commonly and routinely practiced method of recording VDO and VDR based on how comfortable the methods are to the patient as well as, how far they are clinically acceptable to the patient. It has been proposed that VDO alterations must be done gradually in order to establish a new mandibular position in which the patient develop the functions normally [9] . A high VDO decrease might cause displacement of the mandible condyle and articular disk, clicks and articulation pain, whereas the accentuate VDO increase could generate phonetic and occlusal interferences by invasion of the FS [9,11,12,13]. Therefore it is very essential to take the comfort and acceptance of the patient in to consideration before finalizing the measurements.

In a study conducted by Ward and osterboltz[14], stated that swallowing can be used only as guide in determining VDO and Swerdlow[15] in his study suggested that phonetic method as a method in determination of interocclusal distance is more reliable than techniques of swallowing. According to the present study statistics showed highly significant result for phonetic method with |t| value of 2.5298 at P value of 0.0210 and swallowing threshold |t| value of 2.8214 at P value of 0.0113 with mean difference of 0.7mm each respectively. When interocclusal distance with physiologic rest position method and phonetic method were compared have shown highly significant difference with operator-1 with |t|-value 3.2205 at P value of 0.0047 with mean difference of 1.1mm interocclusal distance. However, mean values of swallowing threshold (OP I – 1.5000, OP II – 2.200) significant compared to the values of physiologic rest position (OP I – 2.90,OP II – 2.84) and phonetic method (OP I –1.80, OP II –2.51).

Rivera morales and mohl [16] believes that for the vertical dimention there is certain optimal space and that is not just a point. Rebibo et al think that perhaps there is a great ability to adapt to changes in VDO, but only under rotation about hinge axis[17]. Lim and van was says that determination of VDO says is a combination of art, science and experience[18].

In the present study conducted there was a significant difference in the p values when all the three methods were intercompared. When statistically analyzed the most compatible and comfortable method among the three methods of recording VDO was the swallowing threshold followed by phonetics and then the physiologic method.

However, despite of large number of methods of determining vertical dimension of occlusion based on different systems, techniques and clinical experience, an absolutely safe method for vertical dimension of occlusion is still lacking.[19,20]

LIMITATIONS OF THE STUDY:

1. The study needs to be conducted on a larger sample size
2. There could be Variations in the measurements as there were two operators
3. Vertical dimensions for each method established and recorded at different sittings.

Subjectivity of level of acceptance

CONCLUSION:

It can be concluded from the study that, statistically the mean values of swallowing threshold (OP I – 1.5000, OP II – 2.200) significant compared to the values of physiologic rest position (OP I – 2.90,OP II – 2.84) and phonetic method (OP I –1.80, OP II –2.51).

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