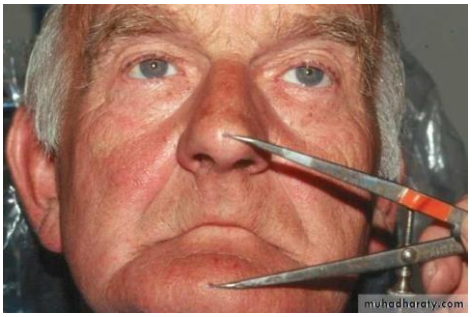
Vertical jaw relation

Maxillomandibular relationship record: a registration of any positional relationship of the mandible relative to the maxillae; these records may be made at any vertical, horizontal, or lateral orientation.

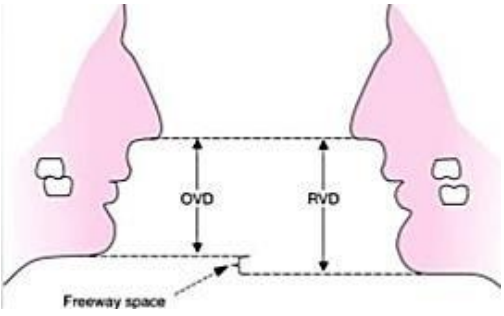
Vertical dimension: the distance between two selected anatomic or marked points (usually one on the tip of the nose and the other on the chin), one on a fixed and one on a movable member.



Rest vertical dimension (physiologic rest position, Vertical dimension of rest): the postural position of the mandible when an individual is resting comfortably in an upright position and the associated muscles are in a state of minimal contractual activity.

Vertical dimension of occlusion: the distance between two selected anatomic or marked points (usually one on the tip of the nose and the other on the chin) when in maximal intercuspal position.

Interocclusal rest distance (freeway space): the difference between the rest vertical dimension and the occlusal vertical dimension. (2-4mm).



Maxillomandibular relation record provides the optimal separation between the maxilla and the mandible. If this record is not measured accurately, the joint will be strained (overextended or under extended). The vertical separation between the mandible and the maxilla depends on the temporomandibular joint and the tone of the muscles of mastication. If the vertical dimension is altered there will be severe discomfort in both the temporomandibular joint and the muscles of mastication. This relation is easiest to record but is very critical. Errors in vertical dimension are the first to produce discomfort and strain.

Factors Affecting Vertical Jaw Relation

Teeth

These act as occlusal vertical stops and establish the relationship of the mandible to the maxilla in a vertical direction in dentulous patients.

Musculature

The opening and closing muscles tend to be in a state of minimal tonic contraction. This determines the vertical jaw relation. Muscles that produce elevation of the mandible (closing muscles) and gravity also help to control the tonic balance that maintains the physiologic rest position.

Importance of Vertical Jaw Relation

1. Functional roles include: mastication, respiration, deglutition, phonetics.
2. Psychological role.
3. Esthetic role.
4. Comfortable role by maintenance health of tissue, mucosa, bones, muscles and (temporomandibular joint).

Effects of increased vertical relation:

1. Speech problems.
2. Sensation of bulky dentures.
3. Premature contact & clicking during function.
4. Increased rate of residual ridge resorption.
5. T.M.J & muscle pain & fatigue.
6. Poor esthetic like separated lips & display of the teeth.
7. Inability to open the mouth widely.
8. Loss of biting power.

9. Difficulty in swallowing.
10. Increased volume or cubical space of the oral cavity.


Effects of decreased vertical relation:

1. Poor esthetic like thin-lipped appearance, prominence of mandible and chin.
2. Presence of excessive wrinkles & folds in corner of mouth which may lead to angular cheilitis.
3. loss of biting power & decreased chewing ability
4. muscular fatigue& pain in T.M.J region
5. cheek biting
6. Neuralgia or other features.
7. Decreased volume or cubical space of the oral cavity.

Vertical jaw relation can be recorded in two positions:

- **Vertical dimension at rest position**
- **Vertical dimension at occlusion**

Both these relations should be recorded. In a normal dentulous patient, the teeth do not maintain contact at rest. The space between the teeth at rest is called the '*free-way*

space'. The free-way space exists only at rest. During occlusion, the teeth come in contact with one another and the space is lost.

The same relationship should be produced in the complete denture. Once the vertical dimension at occlusion is recorded, it should be verified with the vertical dimension at rest (the vertical dimension at occlusion should always be 2-4 mm lesser than the vertical dimension at rest). The denture is fabricated in vertical dimension at occlusion so that the free-way space is formed at rest.

Vertical Dimension at Rest

It is defined as, "*The length of the face when the mandible is in rest position*. This is the position of the mandible in relation to the maxilla when the maxillofacial musculature are in a state of tonic equilibrium. This position is influenced by the muscles of mastication, muscles involved in speech, deglutition and breathing. It is essential to record the vertical dimension at rest as it acts as a reference point during recording the vertical dimension at occlusion.

VD at rest = VD at occlusion + free-way space.

The vertical dimension at rest should be recorded at the physiological rest position of the mandible. In patients with prolonged edentulous, the mandible shifts to a habitual rest position.

The complete denture should not be fabricated using the habitual rest position. Hence the physiological rest position should be determined in these patients before recording vertical jaw relation. When functional movements (swallowing, wetting the lips) are performed, the mandible comes to the physiological rest position before going to the habitual rest position. The physiological rest position is influenced by a number of factors and the following considerations are to be remembered while recording it:

• The position of the mandible is influenced by gravity and the posture of the head. Hence while recording vertical jaw relation the patient should be asked to sit upright, with his/her head upright and eyes looking straight in front.

• Since we are recording a physiological rest position, all the muscles affecting this record should be relaxed. Signs like tension, strain, and nervousness can alter the position of the mandible.

• Presence of any neuromuscular disease in the patient can influence the rest position.

• The patient cannot maintain the physiological rest position for an indefinite period of time. Hence, it should be recorded quickly.

• Incorrect measurement of the rest position can lead to faulty recording of the vertical dimension at occlusion and can lead to injury to the supporting structures and the temporomandibular joint.

Methods of recording V.D.R: V.D.R is measured usually on the face by a ruler between two selected points marked by indelible marker or a triangle of adhesive tape above & below the mouth mostly on the nose & chin. The following methods are used for recording rest vertical dimension:

1. ***Facial measurements after swallowing and relaxing.***
2. ***Tactile sense.***
3. ***Measurement of anatomic landmarks.***
4. ***Speech or Phonetic.***
5. ***Electro-myographic method.***
6. ***Facial expression.***

1-Facial measurements after swallowing and relaxing:

The patient should sit or stand comfortably upright with the head erect with the eyes looking straight ahead, ask the patient to swallow and wipe his lips with his tongue, relax his facial muscles and drop his shoulder. Then measure the V.D.R and repeat until getting a consistent measurement.

2. Tactile Sensation

• The patient is asked to stand erect and open his mouth wide till he feels discomfort in his muscles of mastication.

• Next, the patient is asked to close his mouth slowly. The patient is instructed to stop closing when he/she feels that his/her muscles are

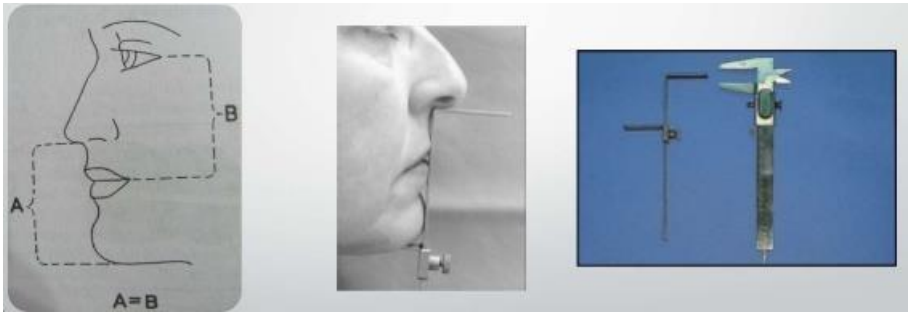
totally relaxed and comfortable.

• The distance between the two reference points is recorded and compared to the measurement recorded by the swallowing method.

• This method relies on patient's perception of relaxation, and will vary for each individual. Hence, at least one additional method should be carried out to confirm these readings.

3. Anatomic landmarks

The distance between the pupil of the eye and the rima oris (corners of the mouth) and the distance between the anterior nasal spine and the lower border of the mandible should be measured using a Willis guide. If both these distances are equal, the jaws are considered at rest. Its accuracy is questionable in patients with facial asymmetry.



4. Phonetics

There are two methods by which the rest position can be recorded with the help of speech. In the first method the patient is asked to repeatedly pronounce the letter 'm', a certain number of times and the distance between the two reference points is measured immediately after the patient stops. In the second method the dentist keeps talking to the patient and he measures the distance between the reference points immediately after the patient stops talking.

5. Electro-myographic method

Rest position of mandible can be determined by means of electromyography which would record the minimal activity of the muscles. All the muscles show greater activity in other positions than in rest position.

6. Facial expression

The experienced dentist learns the advantage of recognizing the relaxed facial expressions when the jaws are at rest. In normally related jaws, the
lips will be even antero-posteriorly and in slight contact. The skin around the eyes and over the chin will be relaxed.

Vertical Dimension at Occlusion

It is the vertical dimension of face when the teeth or occlusal rims are in contact in centric occlusion.

Methods of Measuring:

Vertical relation of occlusion is roughly grouped under ***mechanical methods*** and ***Physiological methods***.

Mechanical methods

• Ridge relation

- Distance from the incisive papilla to mandibular incisors.
- Parallelism of ridges.

• Pre-extraction records

- Profile photographs.
- Profile silhouettes.
- Radiography.

- Articulated casts.
- Facial measurements.

• Measurement from former dentures

Physiological Methods

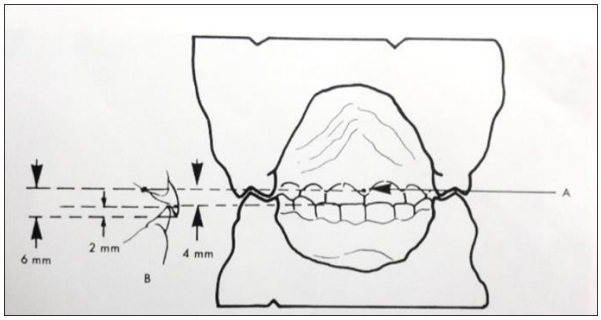
- Power point.
- Using wax occlusal rims.
- Physiological rest position.
- Phonetics.
- Aesthetics.
- swallowing threshold.
- Tactile sense or neuromuscular perception.
- Patient's perception of comfort.

1. Mechanical methods:

• Ridge relation

- **Distance of incisive papilla from the mandibular incisors**:

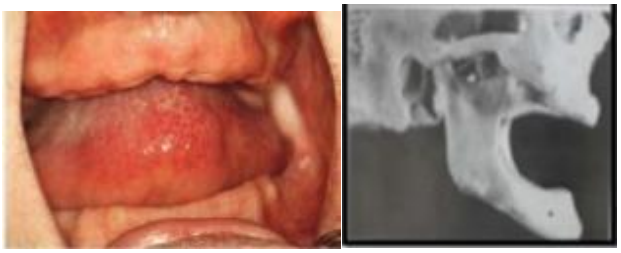
  The incisive papilla is used to measure the patient's vertical relation since it is a stable landmark and is changed little by resorption of residual alveolar ridge. The distance of the incisive papilla from the incisal edge of the mandibular incisors is about 4 mm in the natural dentition. The incisal edge of the maxillary central incisor is an average of 6 mm below the incisive papilla. So, the average vertical overlap of the opposing central incisor is about 2 mm. These measurements must be occurred in trial dentures on the articulator but they don't appear to be relevant in sever ridge resorption.



- **Parallelism of ridges**

  The mandible is parallel to the maxilla only at occlusion. This factor can be used to determine the vertical dimension at occlusion. The mandible of the patient is

adjusted to be parallel to the maxilla. This method cannot be taken as a standard in patients who lost their teeth at different periods of time.



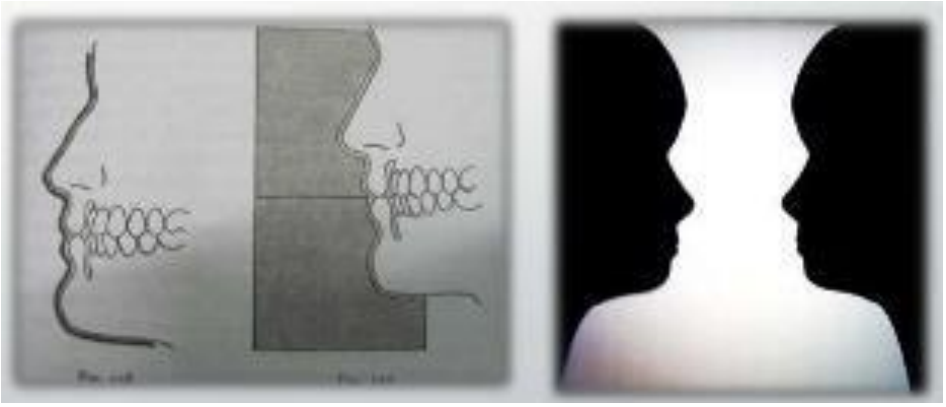
• Pre-extraction records

- **Profile photographs**: Profile photos are made and enlarged to life size. The photographs should be made with the teeth in maximum occlusion. Measurements of anatomical landmarks on the photograph are compared with measurements on the face, using the same landmarks. These measurements can be reevaluated during the try-in appointment.

  Disadvantage:

  - The angulation of the photograph might differ with the patient's posture.

- **Profile silhouettes:** The word silhouette means outline. An accurate silhouette is made with cardboard or contoured with wire using the patient's photograph. This silhouette can be used as a template. Since the silhouette is taken from a pre-extraction photograph it shows the vertical dimension at rest. It is positioned on the patient's face while recording the vertical dimension at occlusion. The chin should be at least 2 mm above the level of the lower border of the silhouette.



Profile Radiograph:

The exposure of a full lateral Cephalometric radiograph is made with the teeth in occlusion. After extraction, trial bases with occlusal rims are made to an apparently correct vertical relation and inserted in the patient's mouth. Radiograph is obtained with the occlusal rims in contact. The two films are compared and necessary adjustment is made to simulate the correct position as in the initial film.

Disadvantages:

- Inaccuracy due to enlargement of the image.
- It is time-consuming and it may result in frequent exposure to radiation.

Articulated casts

When the patient is dentulous, the maxillary and mandibular casts are mounted in centric relation in articulator. After extraction the edentulous casts are articulated in a separate articulator. The inter-arch distance between the edentulous casts is compared with that of the articulated dentulous casts. This method is valuable with patients whose ridges are not sacrificed during removal of teeth or resorbed during a long waiting period for denture construction.

Facial measurements

Two tattoo points are marked on the upper and lower halves of the face before extraction. The vertical dimension is measured at occlusion and recorded. This measurement is used after extraction. The distance between the tattoo marks can be measured by recording the distance from the chin to the base of the nose using dividers (or) calipers before teeth are extracted.

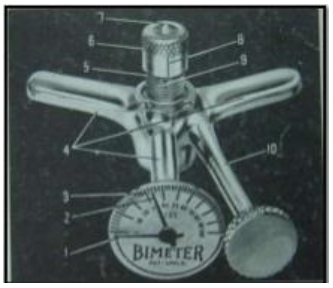
• Measurements of former dentures

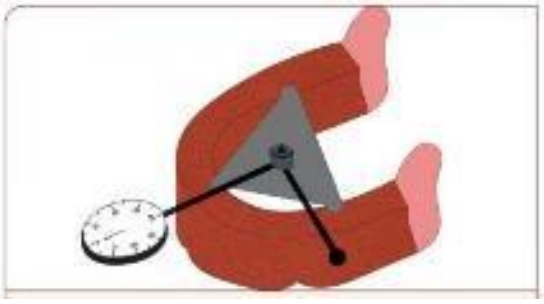
Patient's existing denture is a valuable pre-extraction record. A Boley's gauge is used to measure the distance between the border of the maxillary and the mandibular denture when both these dentures are in occlusion. This measurement is used to determine the vertical dimension at occlusion. The measurements can be correlated with the observation of the patients face to determine the amount of change required.

2. Physiological methods:

Including edentulous patient with no pre-extraction record:

a. Power point: as suggested by Boos, the theory based on that when teeth come into contact, maximum force or power point measured by bi-meter is exerted when this contact occurs at the correct V.D.O. A bimeter is attached to the mandibular record base. This bimeter has a dial, which shows the amount of pressure acting on it.





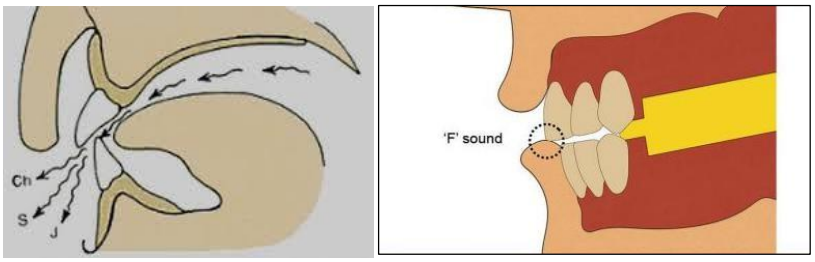
b. Using Wax Occlusal Rims

A tentative vertical dimension is measured with occlusal rims and the casts are articulated in a tentative centric relation. The facial expression and aesthetics are used for the final value.

***c. Physiological rest position*:** a suggested method is to have the patient relaxed when the wax occlusion rims are in place, with the trunk upright & the head unsupported. The patient swallows & lets the jaw relax while the rims are inside his mouth, when relaxation is obvious; the lips are carefully parted to reveal how much interocclusal space is present between the rims. It should be 2-4mm in premolar regions, if it is more than 4mm, the V.D.O may be considered too small & vice versa so the bite rims should be adjusted until the dentist satisfied with interocclusal space with patient comfort & speech & esthetic considerations. This method is not an exact guide when used with other methods; it will determine relation of mandible to maxillae.

d. ***Phonetics* and *esthetics:*** it consists of listening to speech sound production. The production of ch, s, & j sounds brings the anterior teeth close together. If the distance

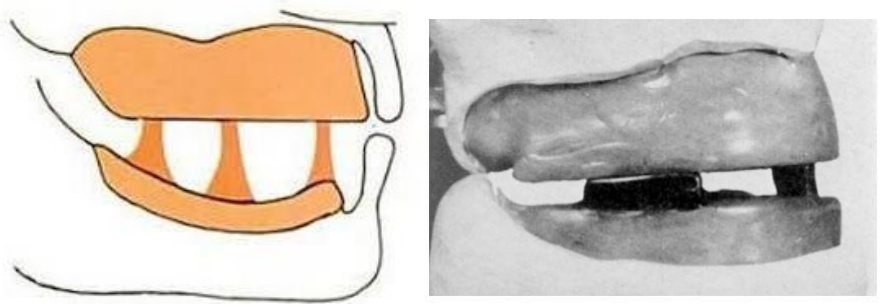
is too large, it means that a too small V.D.O may have been established. If the anterior teeth click together when these sounds are made the V.D.O is probably too great.



Esthetics also is affected by vertical relation of mandible to maxillae like skin tone, contour & support of the lips by anteroposterior positions of the teeth. In decreased V.D.O, the lips are not correctly supported & will be more nearly vertical than when supported by natural teeth.

The Esthetic guide to the correct V.D.O is to select teeth that are the same size as the natural teeth & to estimate the amount of tissue lost from the alveolar ridges.

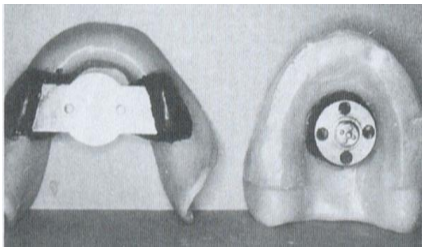
e. *Swallowing threshold:* the theory when a person swallows, the teeth come together with a very light contact at the beginning of the swallowing cycle. On this base, a record of the jaws relation at this point is used as V.D.O. the technique involving building a cone of soft wax on the lower denture base in such a way that it contacts the upper occlusion rim when the jaws are open too wide, then the flow of saliva stimulated by a piece of candy with repeated action of swallowing will gradually reduce the height of the wax cone to allow the mandible to reach the level of V.D.O.

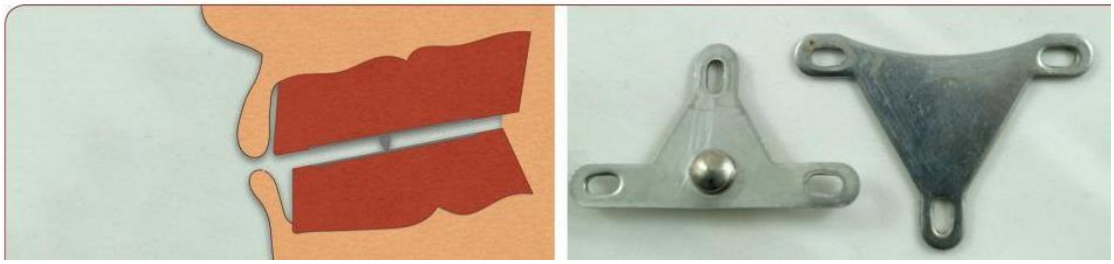


f. **Tactile sense or neuromuscular perception**

This is suggested by Lytle**,** in this technique a central bearing plate is attached to lower occlusion rim and a central bearing screw attached in the palate of maxillary occlusion rim which is adjusted to measure the V.D permits patient to experience through neuromuscular perception the different vertical relations. i.e the screw is adjusted

whether by increase or decrease the opening of mouth until the patient indicates that the dimension is about right.





g. *Patient's Perception of Comfort*

It is a very simple and easy method of determining the vertical relation. Here, the record bases with excessively tall occlusal rims are inserted in to the patient's mouth and the excess base plate wax is removed stepwise till the patient perceives the occlusal height as comfortable. The disadvantage of this technique is that it depends on the patient's co-operation for accurate readings.

The most frequently used tests that aid the dentist in establishing the correct VDO by means of occlusion rims are

1. Visual observation of the space between the rims when the mandible is in its physiological rest position.
2. Judgment of the overall esthetic facial support.
3. Phonetic tests that include observations when the "s" sound is enunciated accurately and repeatedly—the average speaking space.

A further assessment and confirmation of this tentative determination will occur later at the try-in appointment, when teeth are set in the wax trial dentures and the VDO is verified in the mouth. At that time, these methods can again be used to confirm the VDO before completion of the dentures.