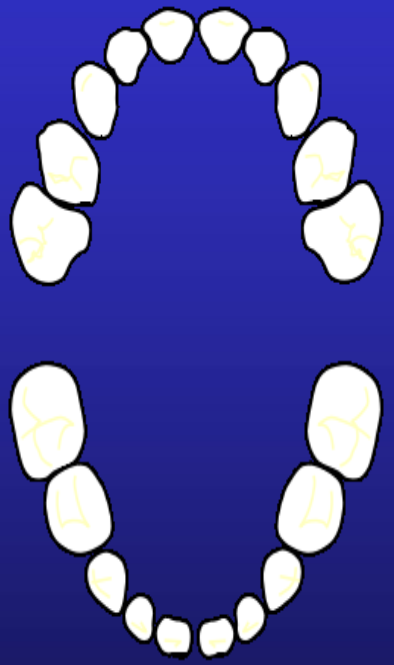
Vertical Dimension

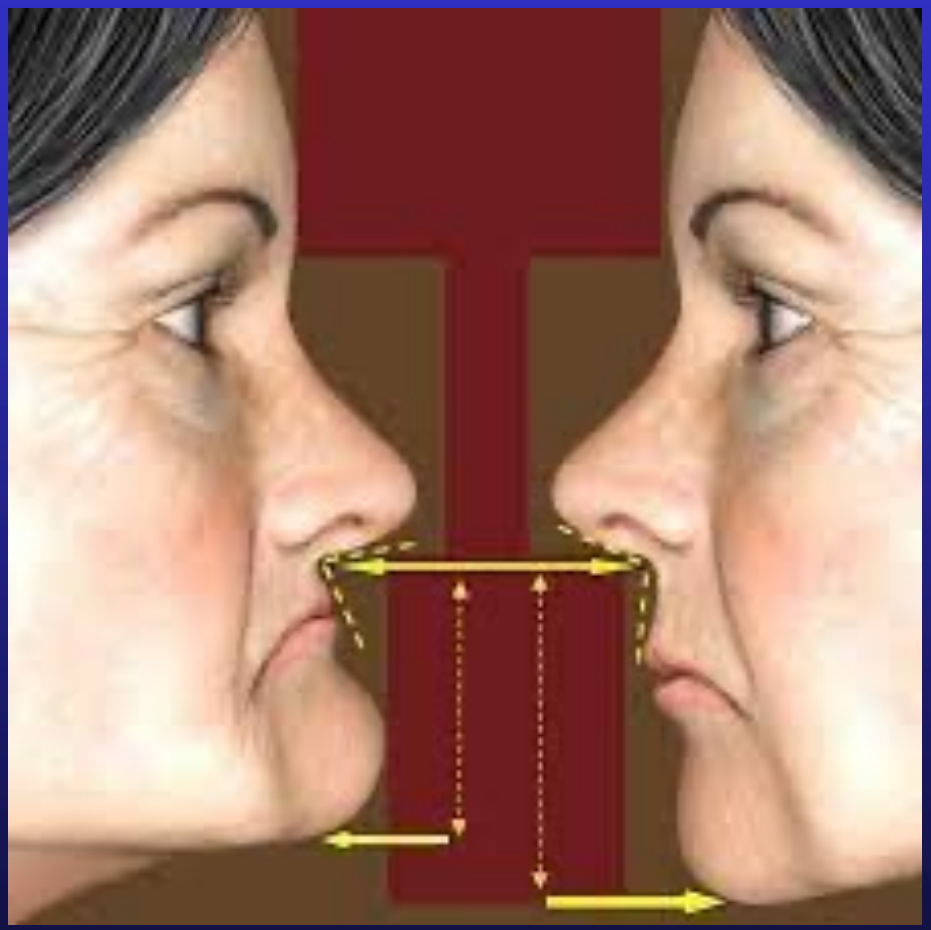


Prosthodontics (YEAR 2)

21 July 2021

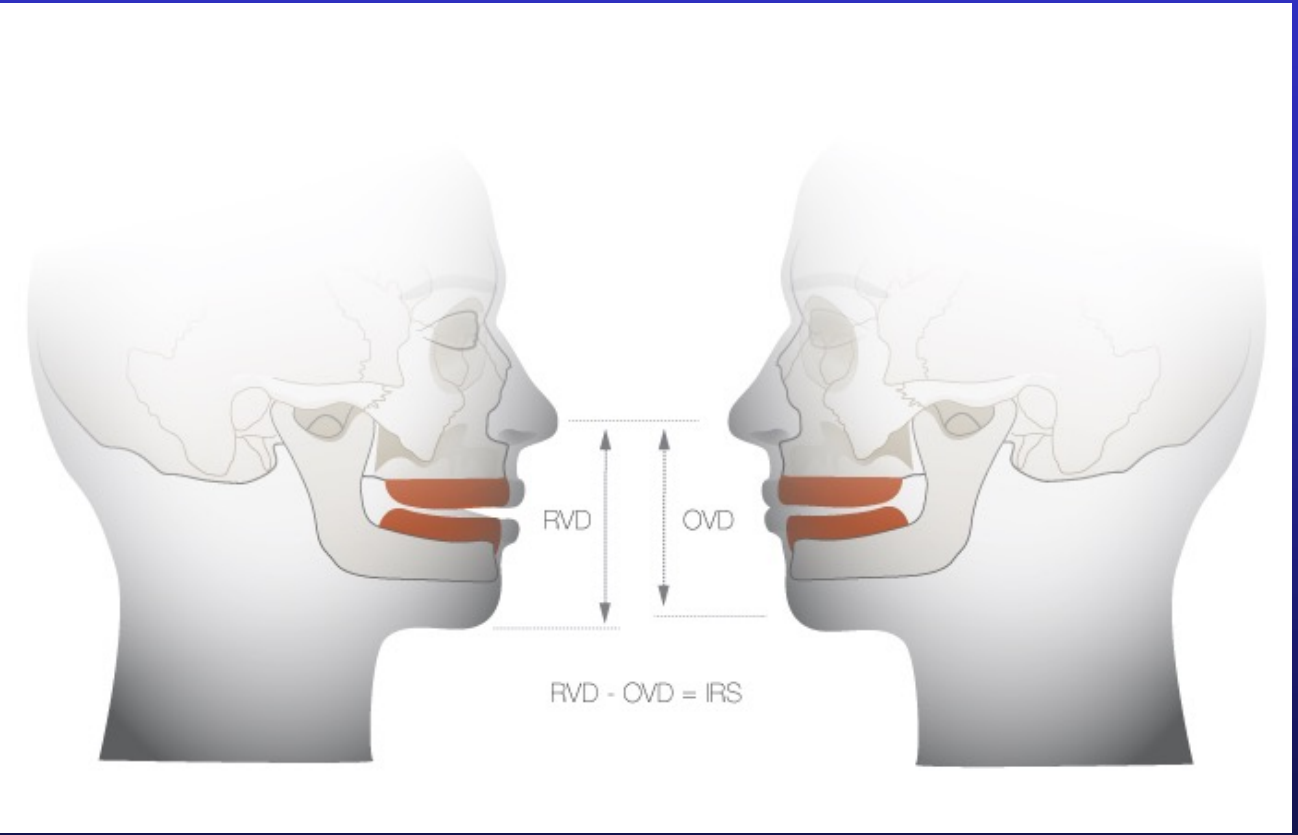
Slides adapted from A/Prof S B Keng

What is Vertical Dimension?



Reduced Restored

What is Vertical Dimension?



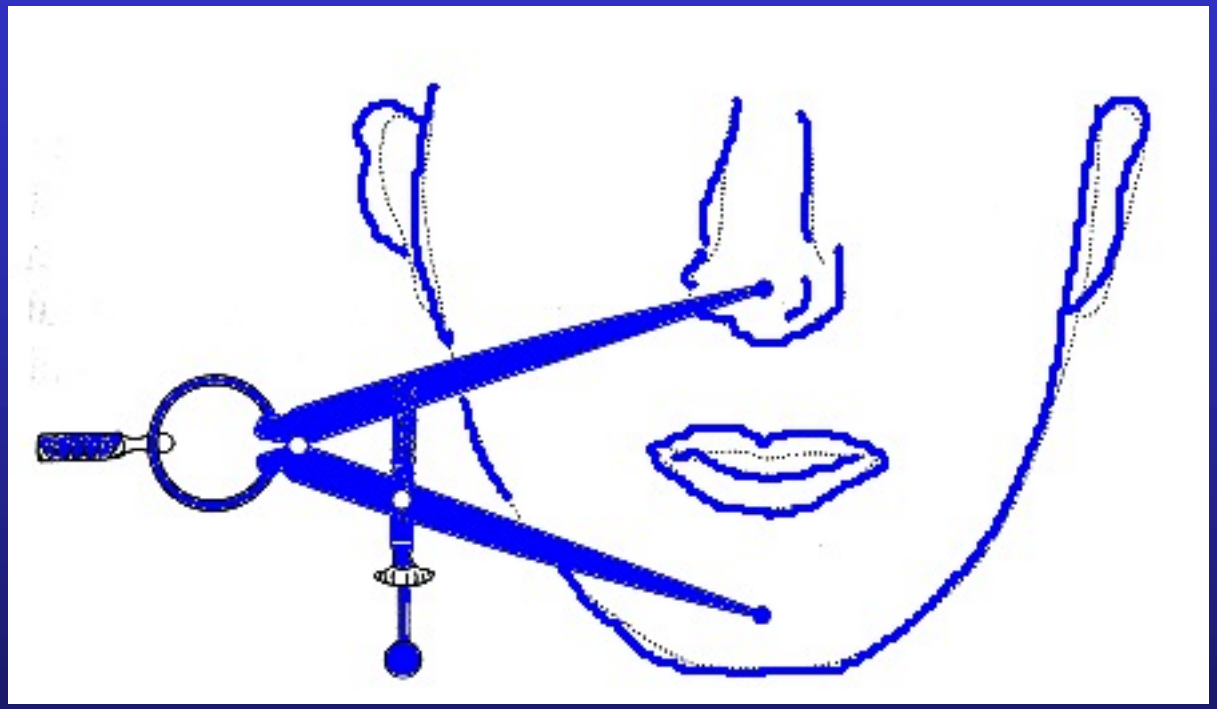
Vertical Dimension

Definition:
The distance between two selected anatomic or marked points (usually one on the tip of the nose and the other on the chin)

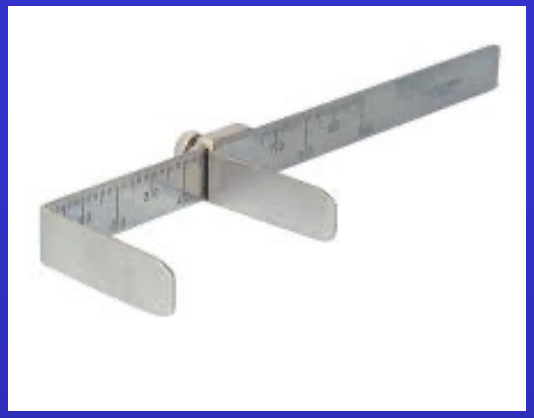
One on a fixed position and the other one on a moveable point

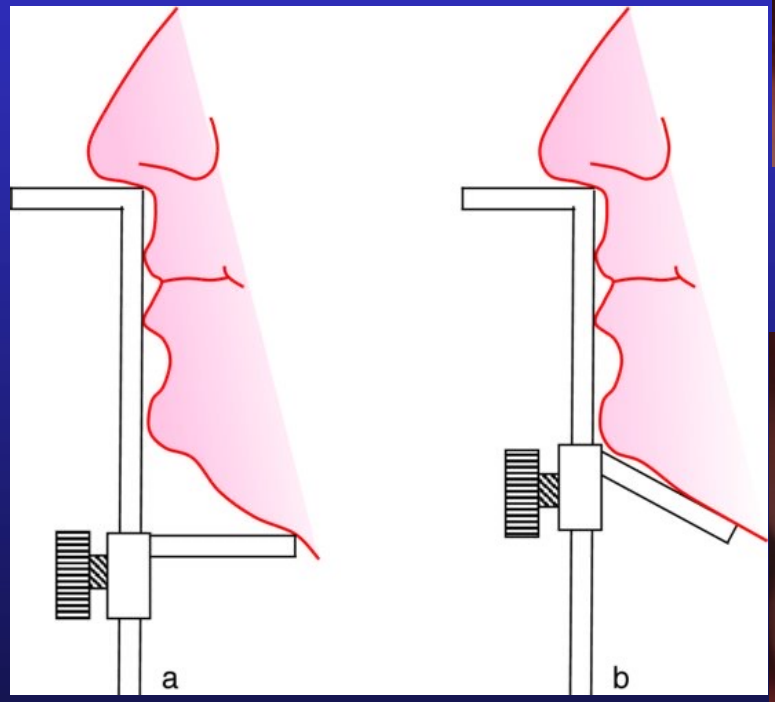
The Glossary of Prosthodontic Terms: **Ninth** Edition. J Prosthet Dent. 2017 May;117(5S):e1-e105

Face Height measurement



Measuring the distance between the marks with dividers with the mandible at rest position or in an occlusal position





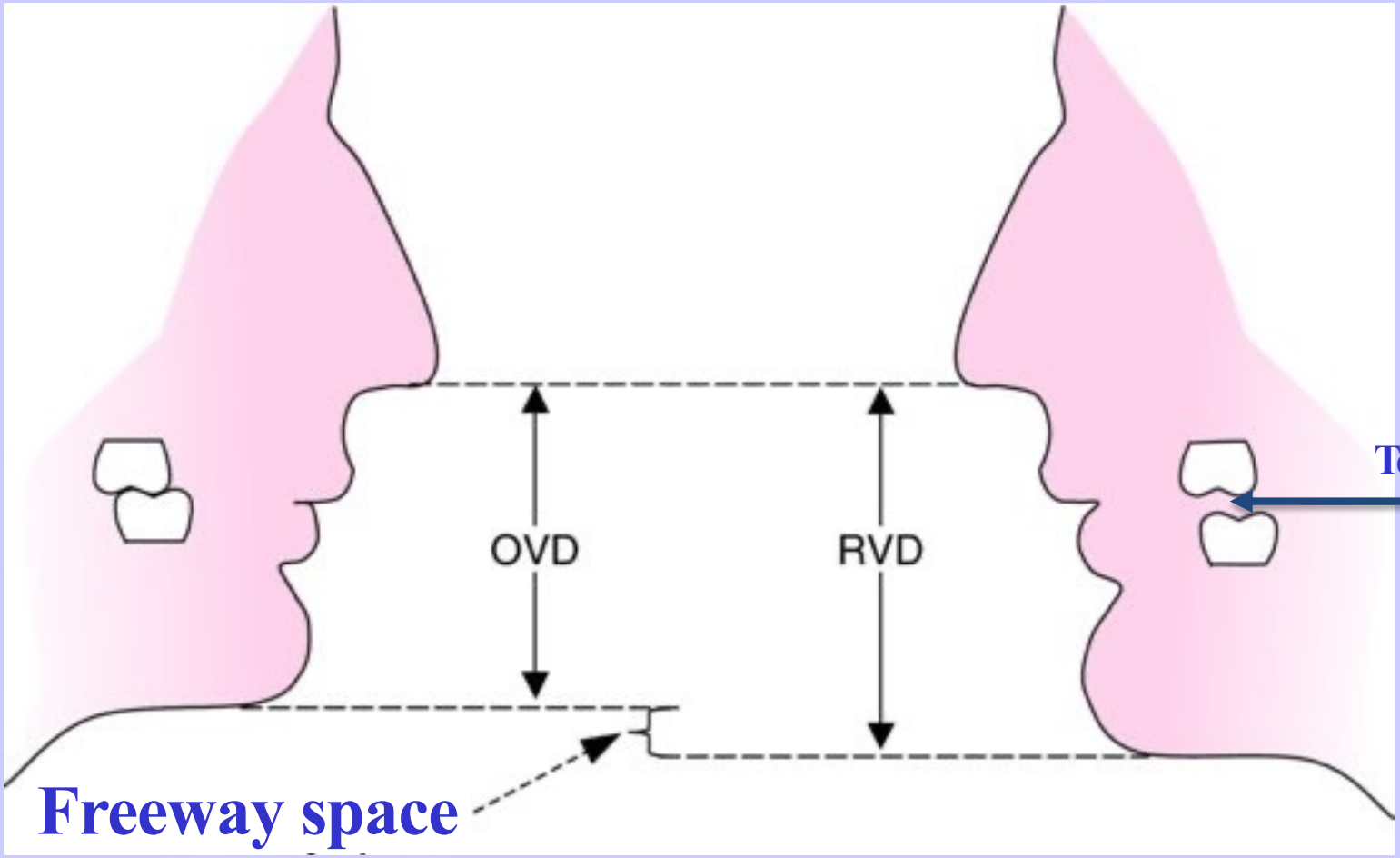
Vertical dimension measurement using the Willis Bite Gauge

Occlusal Vertical Dimension (OVD)

Rest Position

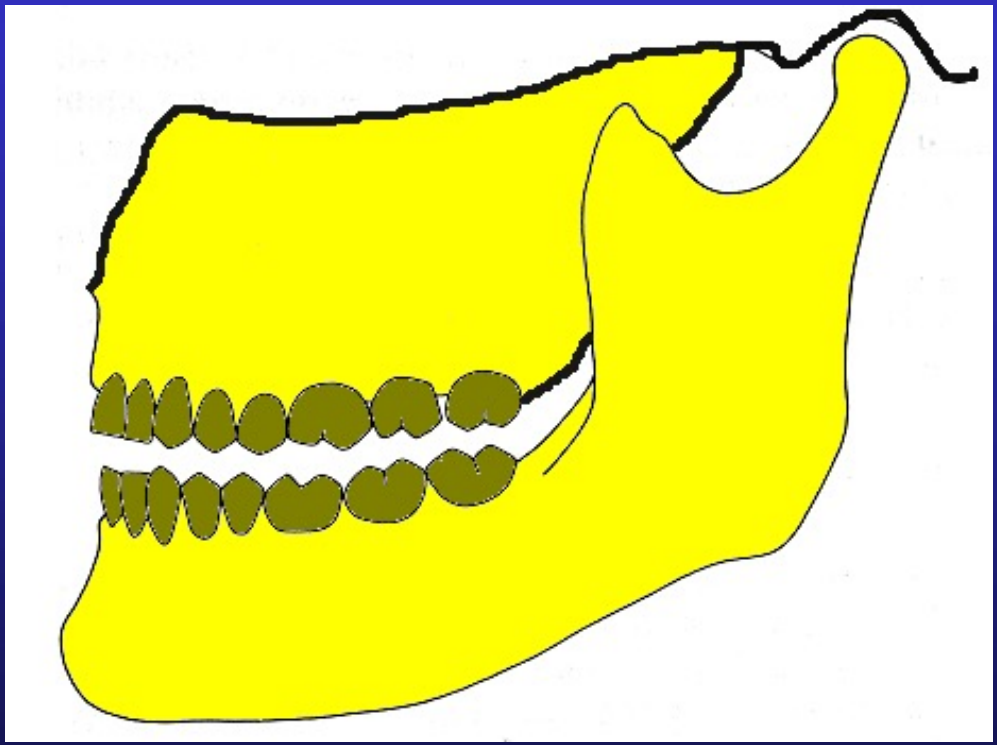
- When the patient is relaxed, the mandible takes up a relatively constant position, known as the rest position.
- The rest position is the postural base from which the jaw automatically returns when such activities are terminated.
- Only minimal activity of the elevator and depressor muscles are acting on the mandible.

Difference between the rest face height (RFH) and the occlusal face height (OFH) is the freeway space (FWS)



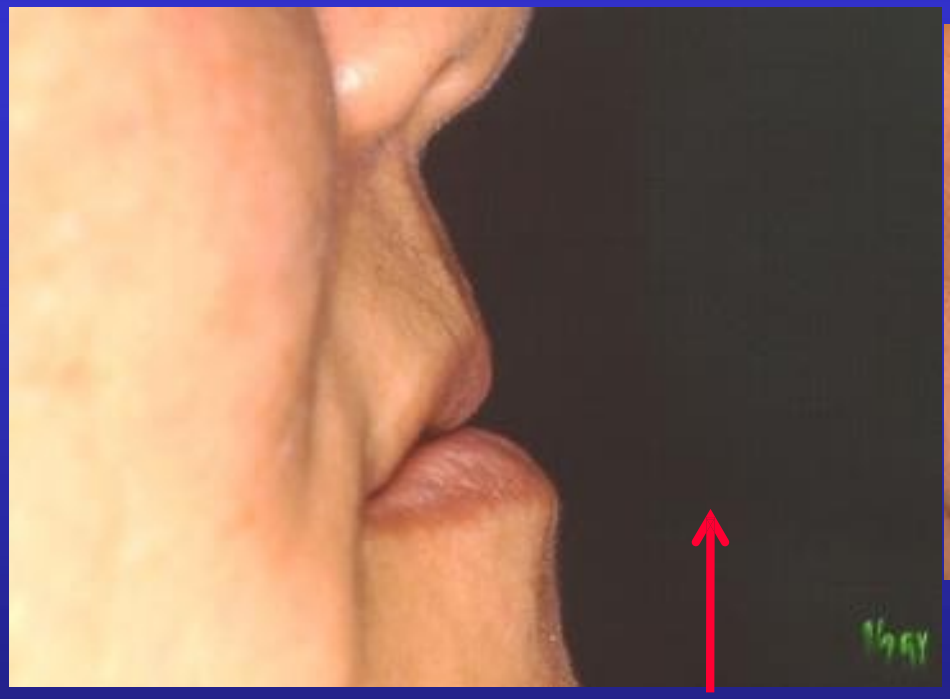
Relaxed or Rest position of the mandible

The jaw is slightly parted and the teeth are out of contact



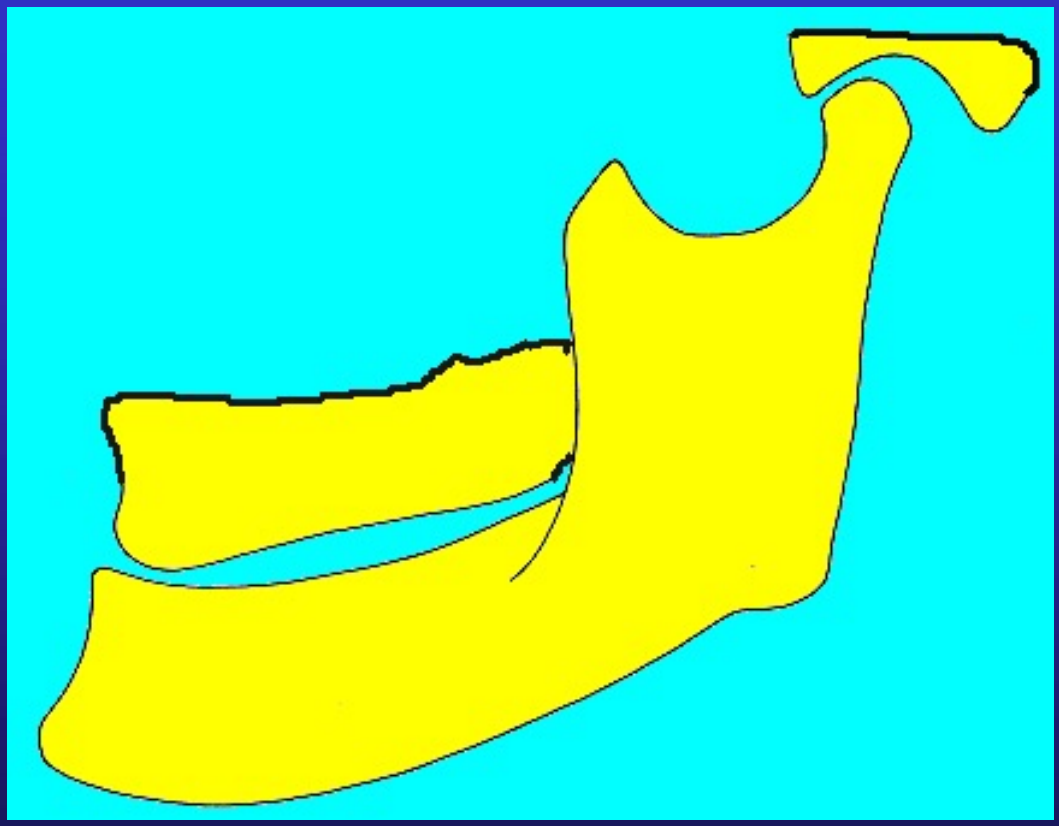
Clinical Significance of the Rest Position

- Tooth position ceases to exist once the natural teeth have been extracted.
- In order to establish an acceptable face height in the edentulous patient, a basic position which is reproducible is necessary.
- The Rest position is often used.
- Once the Rest Face Height is established then the occlusal face height can be derived.
- The Free Way Space(FWS) can then be given.



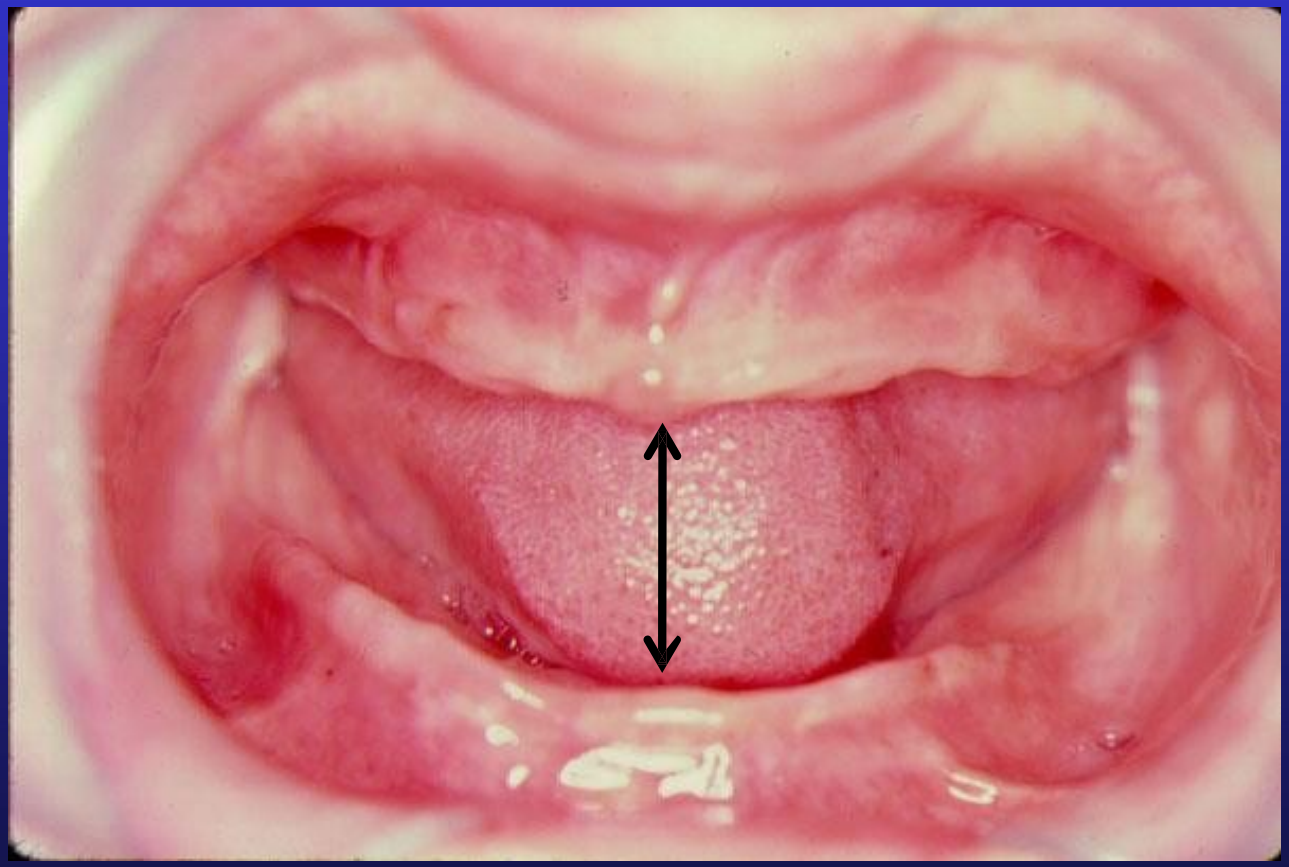
Fully edentulous patient

LOSS of TEETH



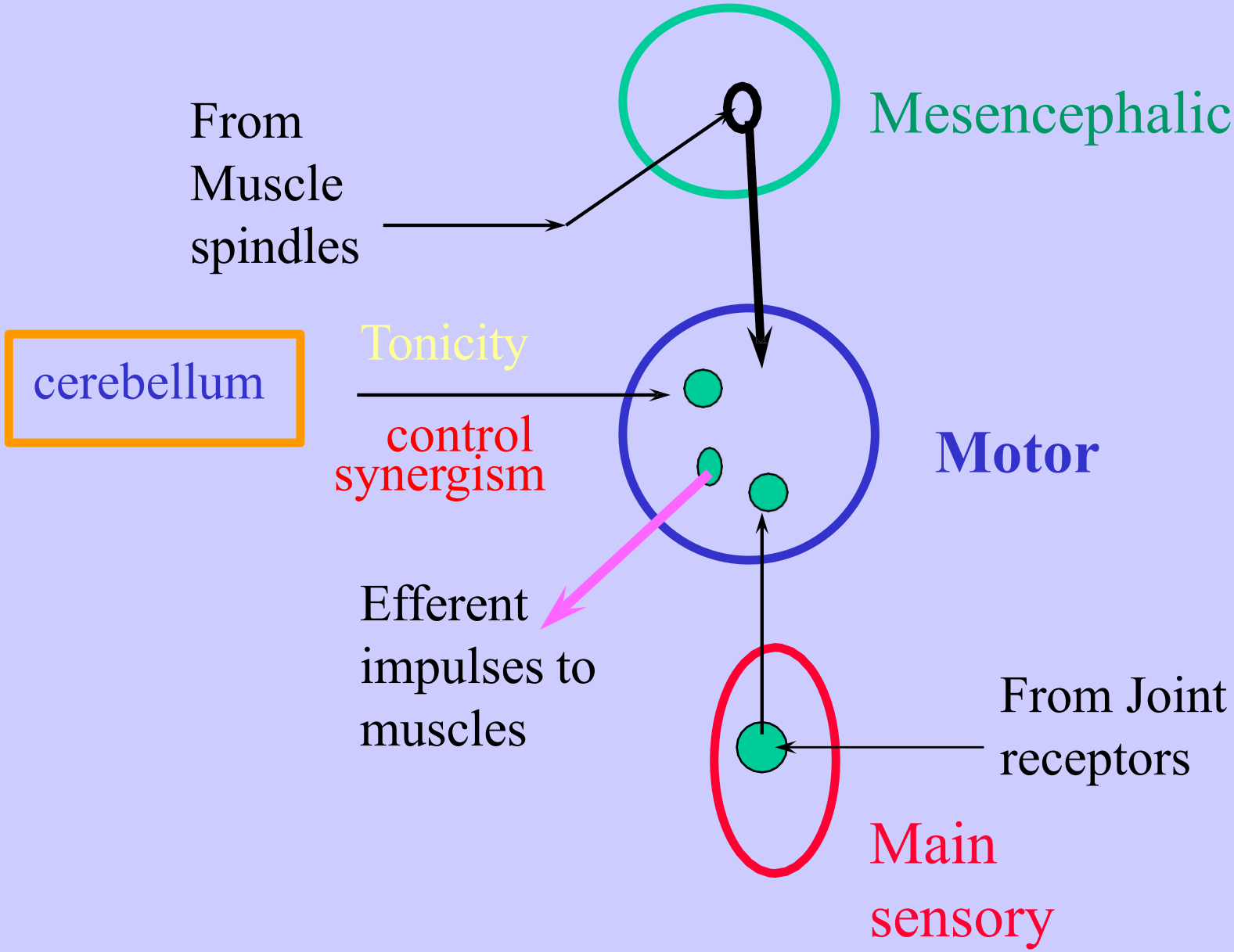
Complete loss of tooth guidance
of the mandible in edentulous jaw

Vertical Dimension



Assessment of Dimensions the inter-ridge space or between the occusal surfaces of upper and lower denture intraorally

Pathways controlling Jaw Positions



Neurophysiology of the rest position

- Efferent impulses(from Motor nucleus) bring about contraction of the muscles of mastication.
- Tonicity maintained by influence on the motor nucleus of impulses from the cerebellum.
- Muscle spindles to mesencephalic nucleus and joint position from main sensory assist in postural position of the mandible.
- The rest position constancy can be explained by the stretch reflex.

Control of Rest Position

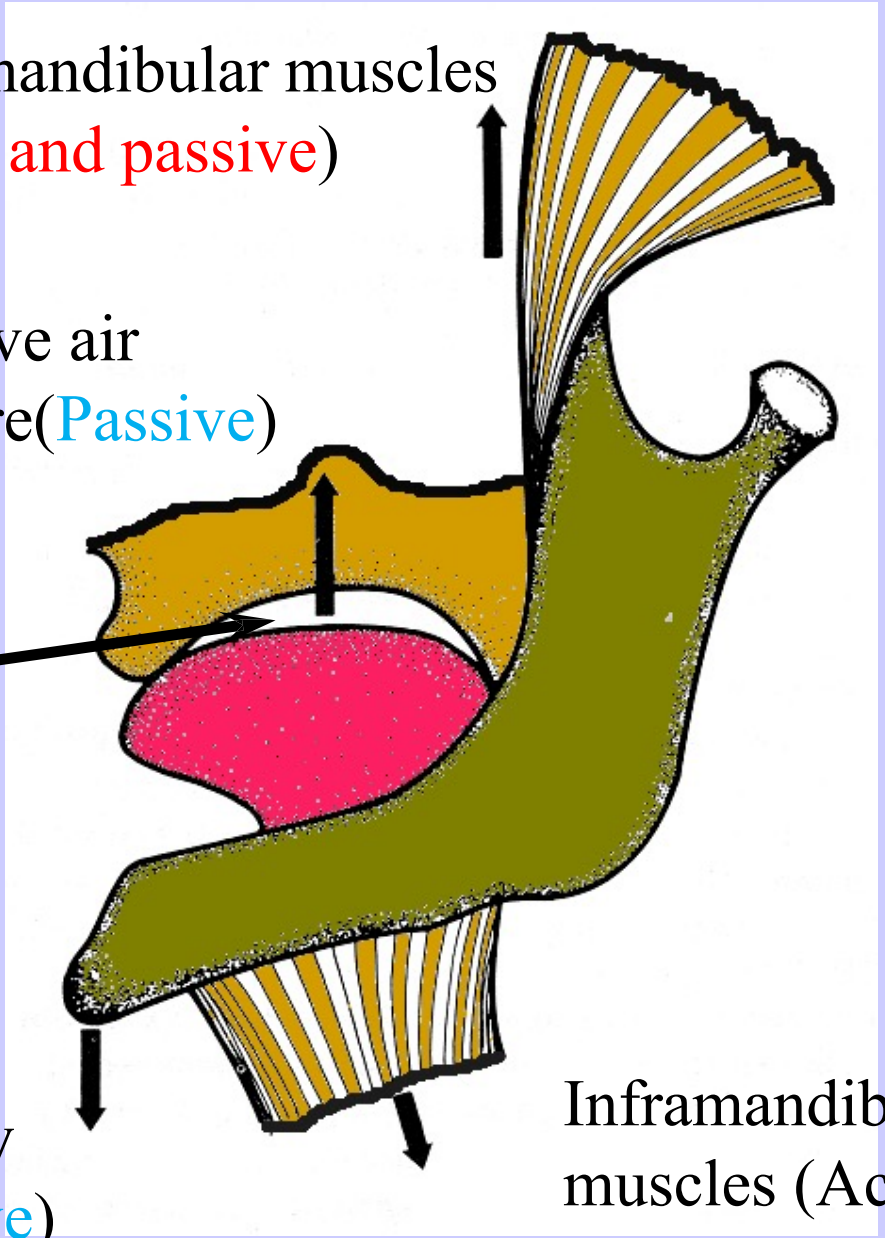
- The rest position of the mandible is the result of a balance of forces.
- Passive and Active forces are involved.

Forces which determine the rest position of the mandible

Supramandibular muscles (active and passive)

Negative air pressure(Passive)

Space of donders -ve presssure



Gravity (Passive)

Inframandibular muscles (Active and passive)

Passive forces

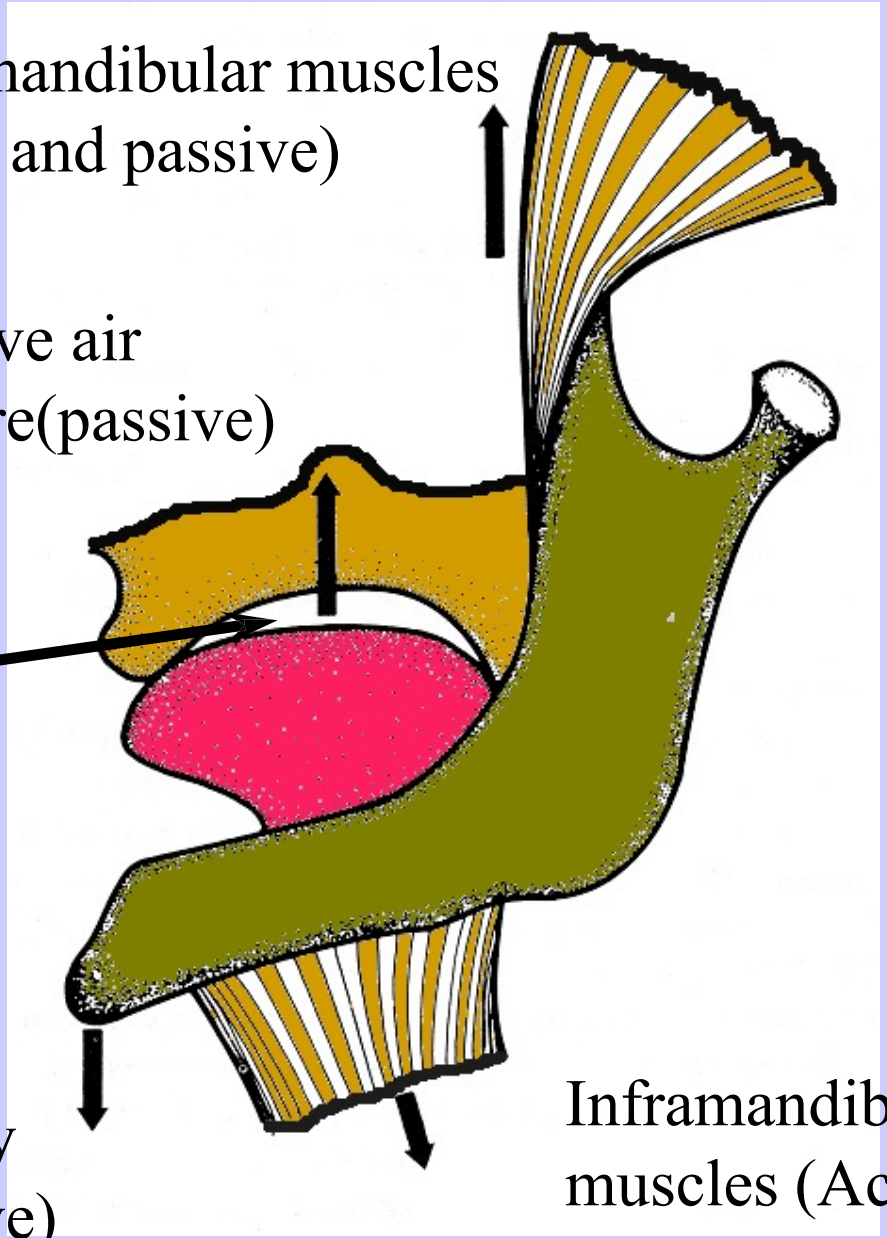
- Muscles The Elastic nature of the muscle fibers and the connective tissue elements.
- In the truly relaxed state , the passive forces inherent in the muscles are able to maintain the rest position.
- However the truly relaxed state is rarely evident.

Passive forces

- Gravity It is a constant force

- Gravitational forces will be reduced in different body positions of the mandible. e.g. supine, lower teeth extracted or lower denture removed from the mouth.

Forces which determine the rest position of the mandible



Supramandibular muscles (active and passive)

Negative air pressure(passive)

Space of donders -ve presssure

Gravity (Passive)

Inframandibular muscles (Active and passive)

Passive forces

- Negative air pressure. within the oral cavity.
- Closed box in the majority, anterior lip seal and posterior dorsum of tongue against soft palate.
- The space between the tongue and the soft palate (Space of Dander's) is a negative air pressure and it has been suggested that this pressure differential which helps support the mandible in the rest position.

Active forces

- Continuos low grade motor unit activity in the muscles attached to the mandible.
- Most of the activities seen in the supramandibular muscles.
- Muscles spindles and the stretch reflex.
- Mechanoreceptors within each temporomandibular joint capsule relay information which indicates the position of the head of the condyle

Active forces

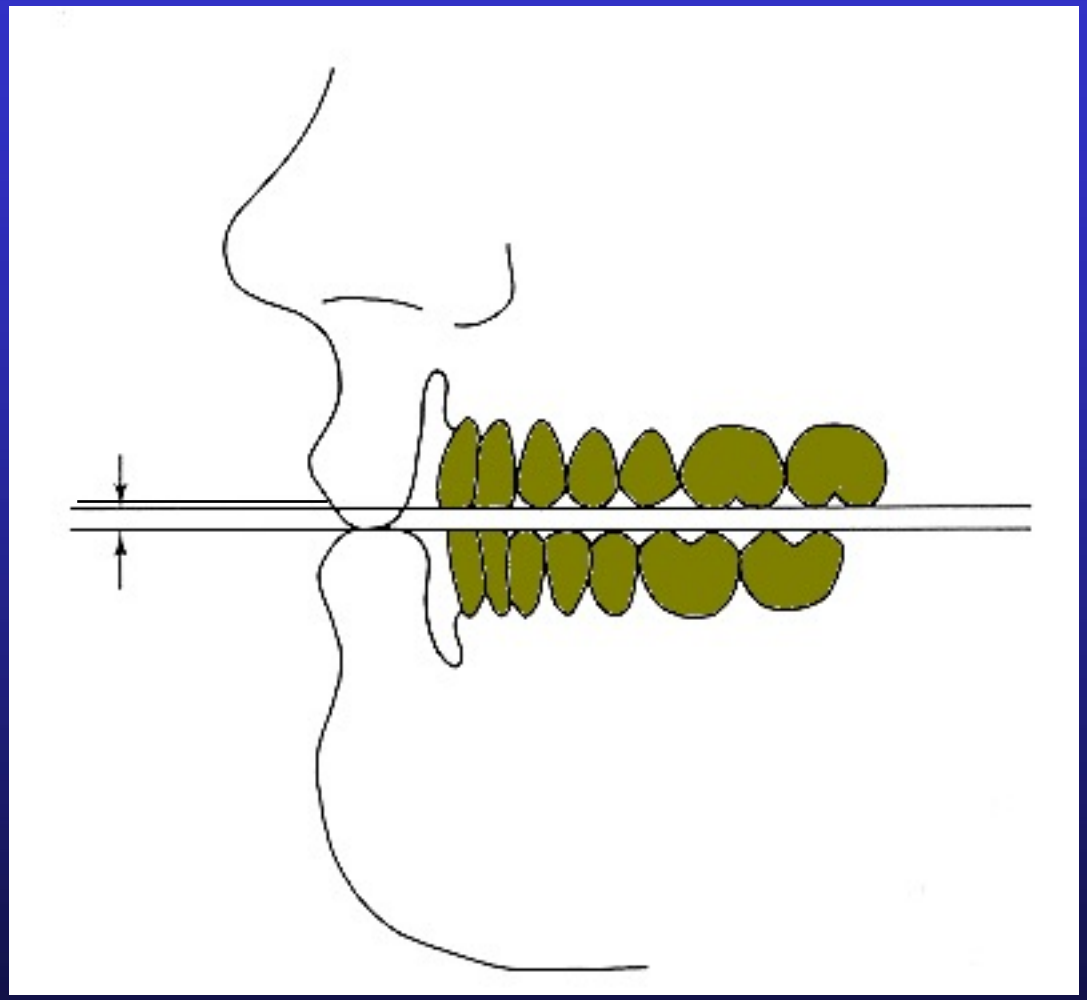
- Changes in the head and neck positions affect the position of the head and thus the mandible position.
- External factors like pain, stress and drugs influence the jaw position.
- Respiration

Free Way Space FWS

- The space between the occlusal surfaces on the maxillary and mandibular teeth when the mandible is in the resting position is the free way space.
- This space is wedge shaped being larger in front of the mouth where the separation is about 2-4 mm.
- The presence of the FWS allows relaxation of the masticatory apparatus.
- The teeth are out of contact

Free Way Space (FWS)

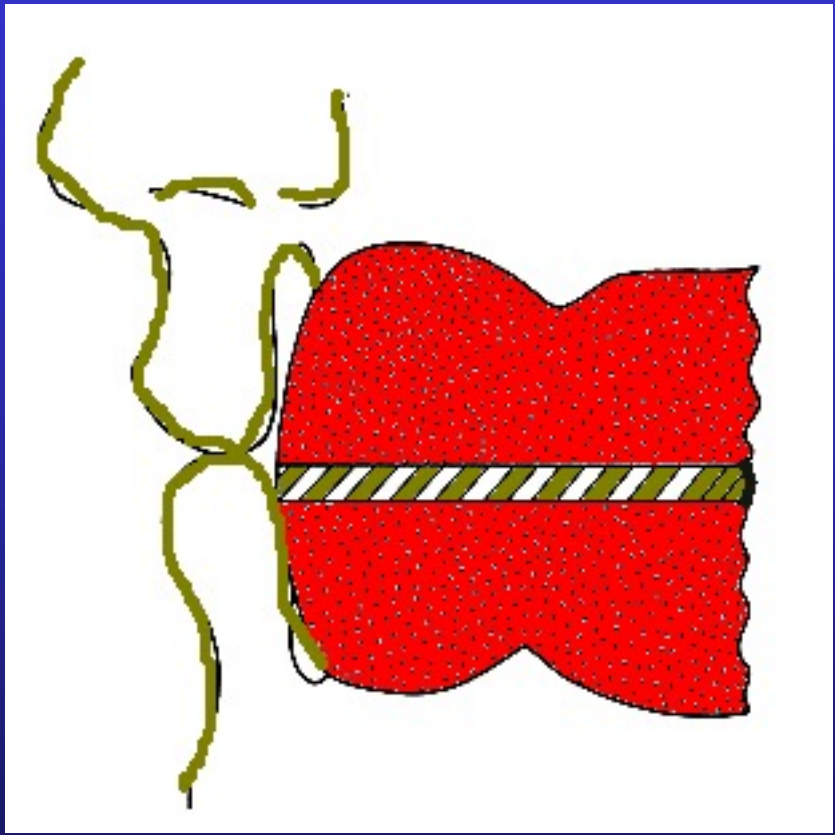
FWS



FWS (Inter-occlusal clearance) is the space between the teeth when the mandible is at rest

Occlusal Rims in Contact

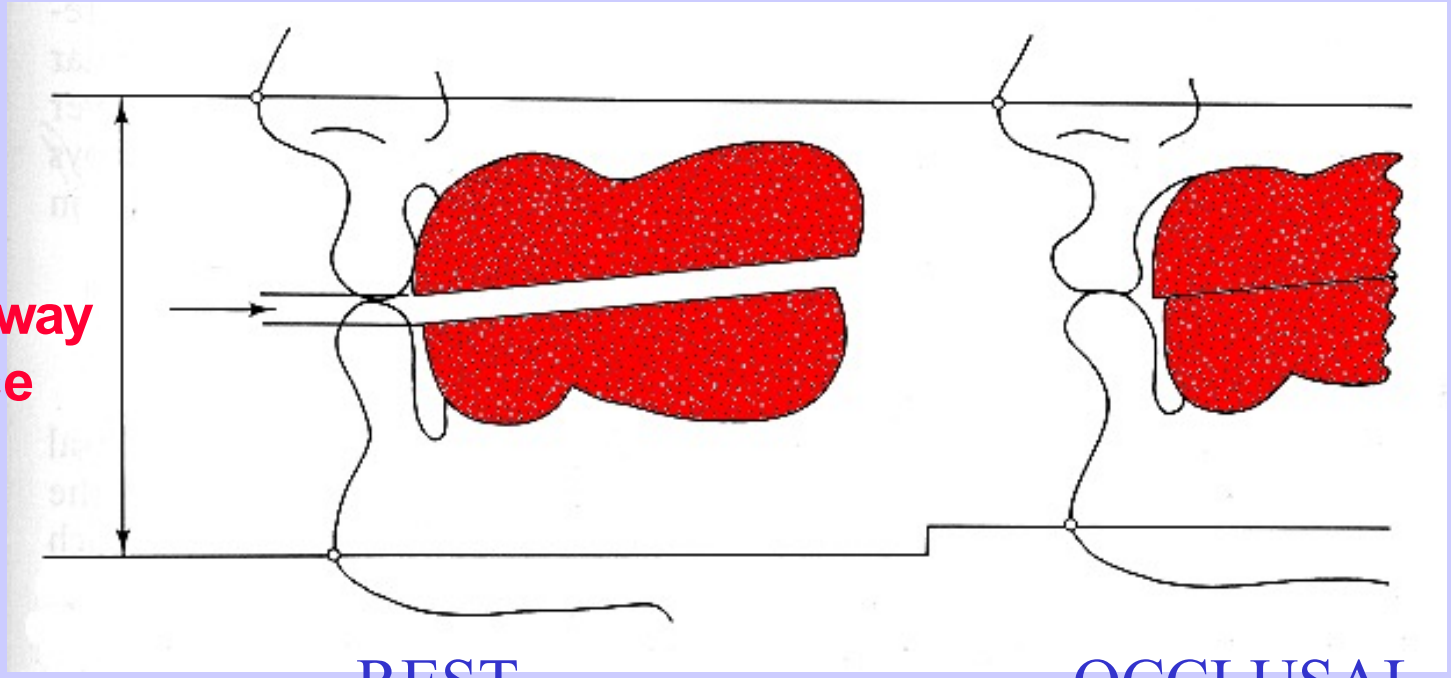
Lips just contacting



Indicates the rest position of the mandible when the occlusal rims are in contact.

If the ruled section wafer is removed from the lower rim, that amount of space is the FWS

Rest and Occlusal position of mandible



Free way space

REST POSITION

OCCLUSAL POSITION

Upward movement of Chin

Occlusal vertical dimension (OVD)

- This is the vertical separation of the upper and lower jaw when the

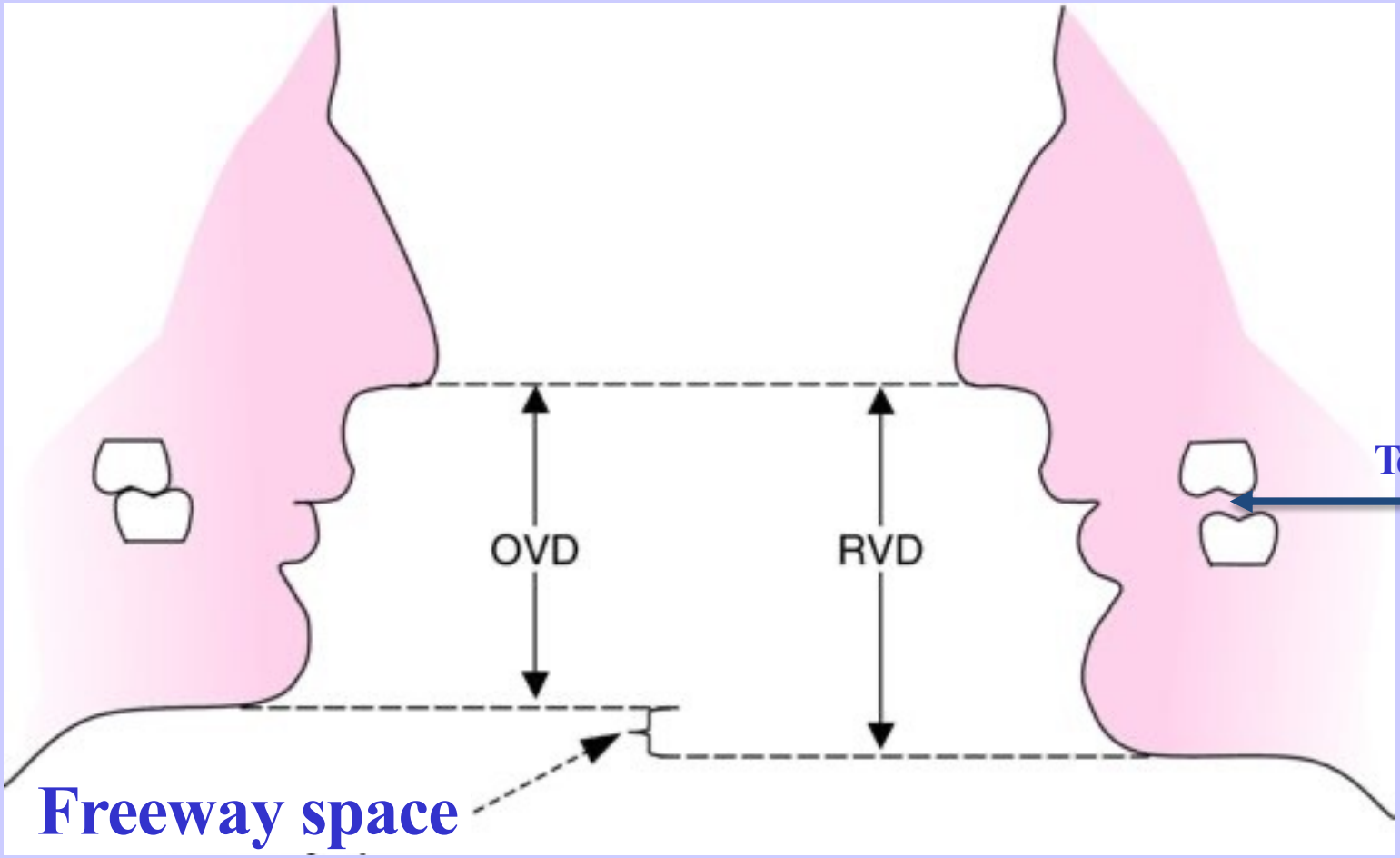
- Occlusal surfaces of the teeth are in contact in dentate patients (or) bite block rims in edentulous patients

If Inadequate or NO Free Way Space

- The denture bearing tissues will be subjected to excessive loading.
- In full mouth bridgework is present, the result could be destructive on the prosthesis and the joints.

There is a decrease in VD in this patient (over-closed)

Difference between the rest face height (RFH) and the occlusal face height (OFH) is the freeway space (FWS)



Short term variables

- Position of the body: The RFH is reduced if the patient is supine.
- Position of the Head : The RFH is increased as the head is tilted back or decreased when the head is tilted forwards.
- Breathing : Increase in FWS during inspiration
- Lower Denture : The RFH is increased when a lower denture is placed in the mouth.

Short term variables

- Stress : The RFH is reduced in response to emotional stress.
- Pain : The RFH is reduced in response to pain.
- Drugs : The response is dependent on the drug taken.

Long term variables and influence

- **Habit of jaw posturing**
  - Forward posturing of the mandible may occur in mouth breathers. Patients may adapt a forward posture to reduce the space to be closed by the lips during breathing and speech.

Long term variables and influence

- **Long term denture wearing**
  - **Same dentures worn over a long period of term will result in a reduction of the occlusal face height (OVD) due to alveolar bone resorption. The rest position of the mandible adapts to this change and takes up a position closer to the maxilla.**
  - **Long term studies have shown a reduction of 7 mm bone height over a 7 to 10 year period. The RFH also decreases but to a smaller degree.**
  - **Resultant increase in FWS.**
  - **Older patients we tend to give a bigger free way space.**

Methods of Obtaining Vertical Dimension

Obtaining Vertical Dimension

3 procedures

1)Obtaining the postural position (Usually the RFH) of the mandible of the patient

2)Decide how much free way space is suitable ?

3)Making reasonably accurate measurements.

At the current moment there is still no definite accurate method of assessing the vertical dimension of occlusion in patients.

Clinical judgment plays a major role.

1) Pre-extraction records in determining vertical dimension

a) **Dakometer**- Instrument that can record the nose-chin height.

The upper member of instrument is placed at the bridge of the nose. The lower is a spring loaded arm fitting beneath the chin. The middle component is adjustable anterior posteriorly to contact the tip of the central incisors.

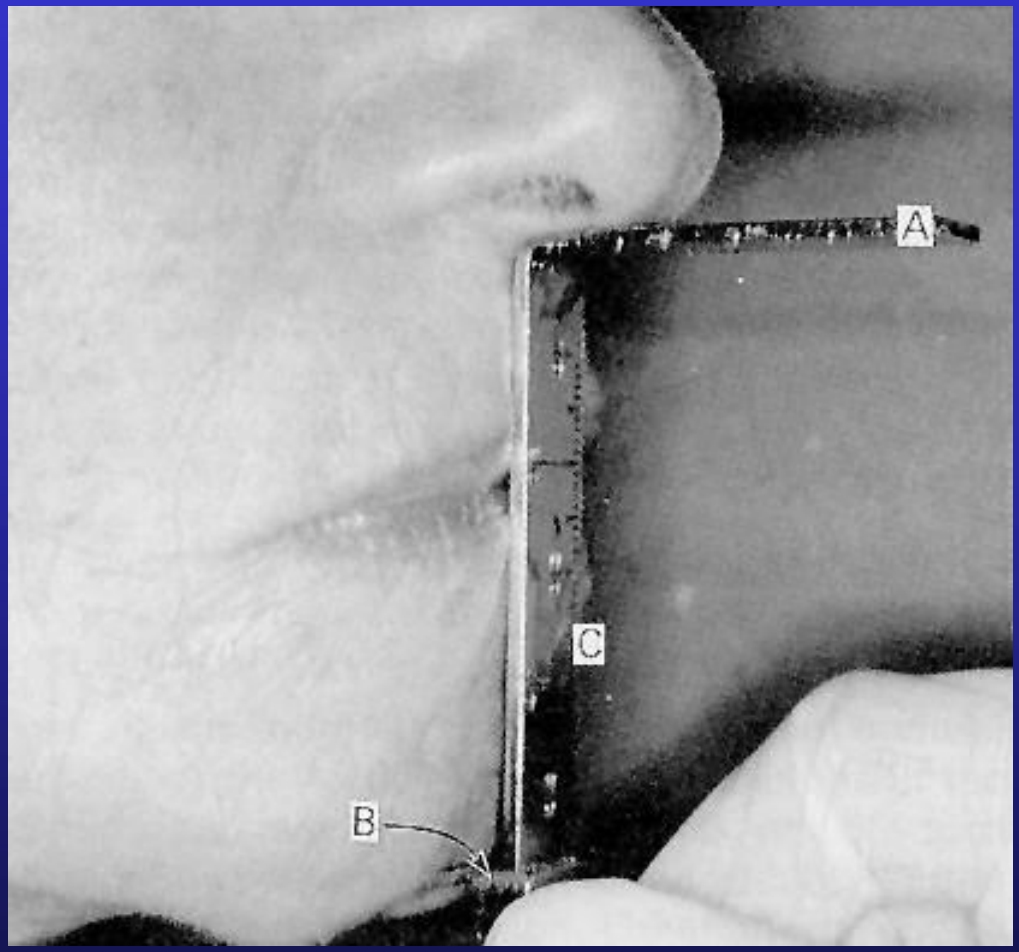
1) Pre-extraction records in determining Vertical Dimension

b) Willis gauge

Useful instrument to measure the nose (Alar) chin height.

Small and handy instrument.

WILLIS gauge in position



Nose chin measurement taken in mm

1) Pre-extraction records in determining Vertical Dimension

c) Profile tracings

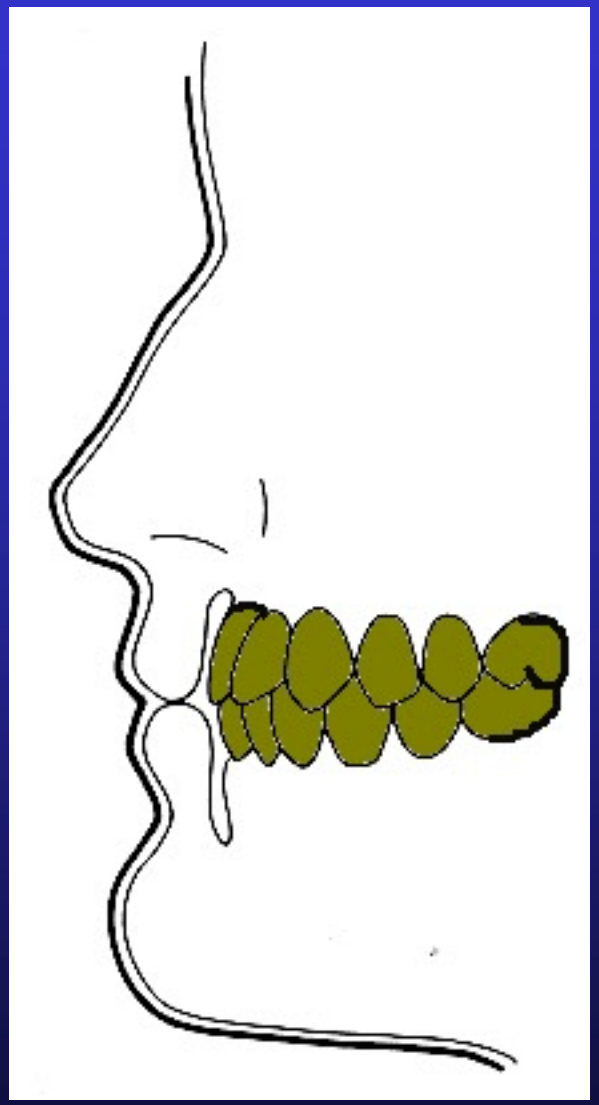
Soft tissue profile of the face at the vertical dimension of occlusion is traced and kept for future record.

d) Clear resin mask

A clear resin mask is made of the patients face. The shape and profile is kept. Method is tedious and may distort the soft tissues.

Previous methods tried

Eg. Profile tracing



Profile Template

Profile template with horizontal lines drawn to indicate position of maxillary central incisor

1)Pre-extraction records in determining Vertical Dimension

e) Clinical profile photographs & written records

A good and simple way to asses the lip posture of patients when they had teeth present.

Can also assess the vertical dimension by proportionate analysis.

1) Pre-extraction records in determining Vertical Dimension

f) articulated casts of the mouth

Good to keep articulated casts of dentate patients.

Measure the distance between the upper and lower labial frenum with dividers when the teeth are in centric occlusion

2) Physiologic Rest Position

- Most common method
- Tallgren study: establish rest face height by a combination of mild fatigue followed by swallow and relaxation with eyes closed.

2) Physiologic Rest Position

- **Facial expression: Recognizes the relaxed facial expression when the patient is at rest.**
- **In normal Class I jaws, the lips will be even anterior posteriorly and in slight contact.**
- **Class II. The lips will not be in even contact, the lower lip is usually posterior to the upper lip and no contact.**
- **Class III . The lower lip will be anterior to the upper lip and not in contact.**

2) Physiologic Rest Position

- Repeated sound of word example " EMMA" .
- Patient practices word until he is aware that the lips is just in contact. Ask patient to say "EM". then stop all jaw movements and measure the distance between two established points of reference.
- Usually Two marks made one on the nose and the other on the chin.

3) Closing forces to establish VD

- Theory is based on the premise that maximum closing force can be exerted at the vertical dimension of occlusion.
- A force meter is attached to the upper and lower base plate. (Boos,s Bimeter)
- Pressure is recorded and the maximum force possible is correlated with the measurement of the occlusal face height.

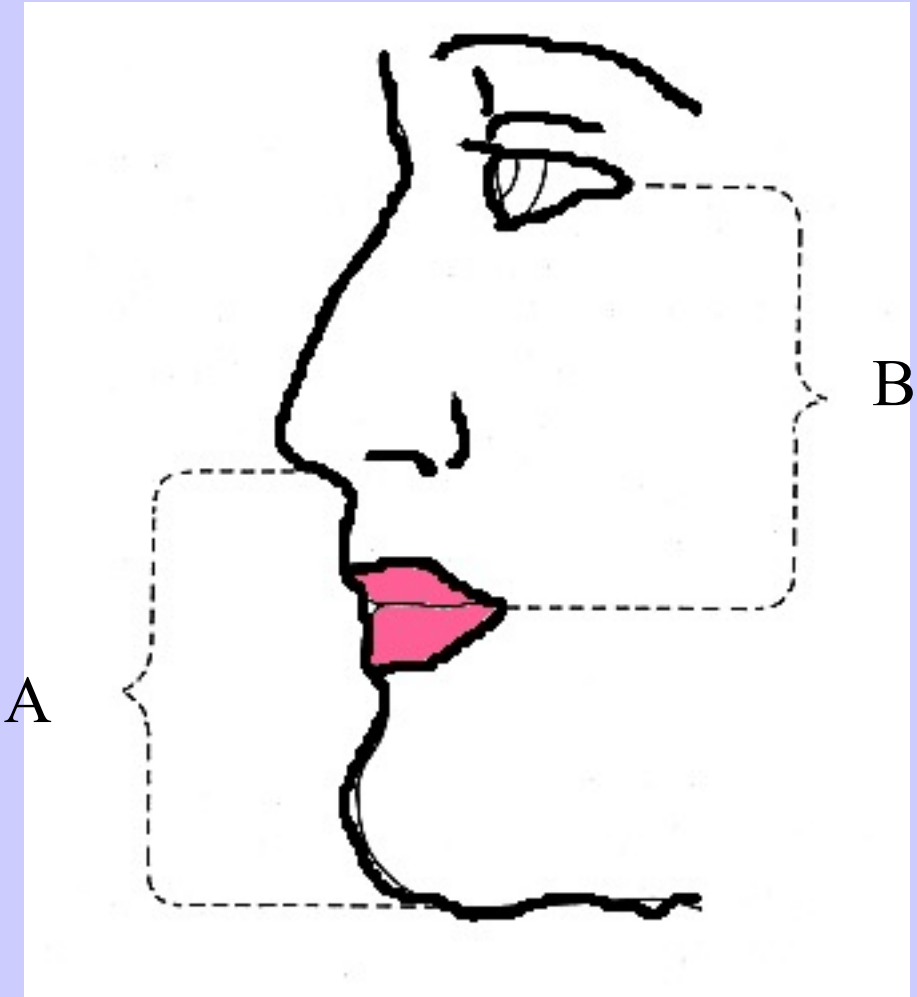
4) Tactile Sense (e.g. use of a Timmer screw device)

- Based on the patients proprioception of the position of the mandible.
- The patent can tell when he feels comfortable at the jaw separation when he had teeth.
- The device is attached to the lower rim and has an screw device (Like a miniature micrometer screw gauge).
- The central bearing device is first adjusted until is is first over open.
- Then it is adjusted down till it is overclosed.
- Next it is adjusted up till he finds a comfortable level of occlusion .
- This is then taken as the OVD.

5) Facial dimensions in establishing VD

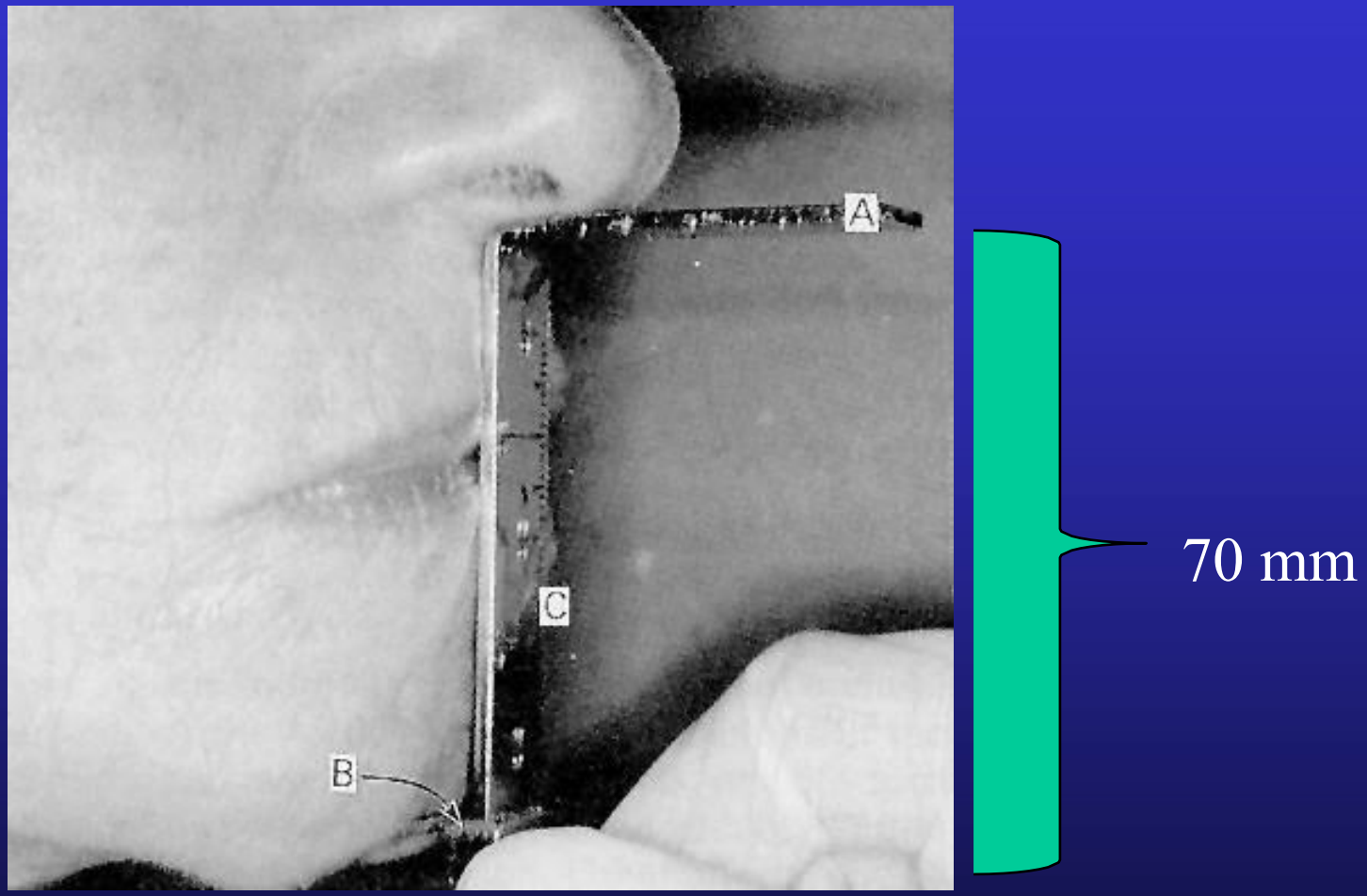
- Uses facial measurements to determine Vertical dimensions.
- Willis facial proportion: The distance from the corner of the eye to the junction of the lips is equaled to the distance between the subnasion and gnathion.
- Accurate only in patients who have a proportionate face. i.e. not long or short face syndrome

Details of facial proportion described by Willis



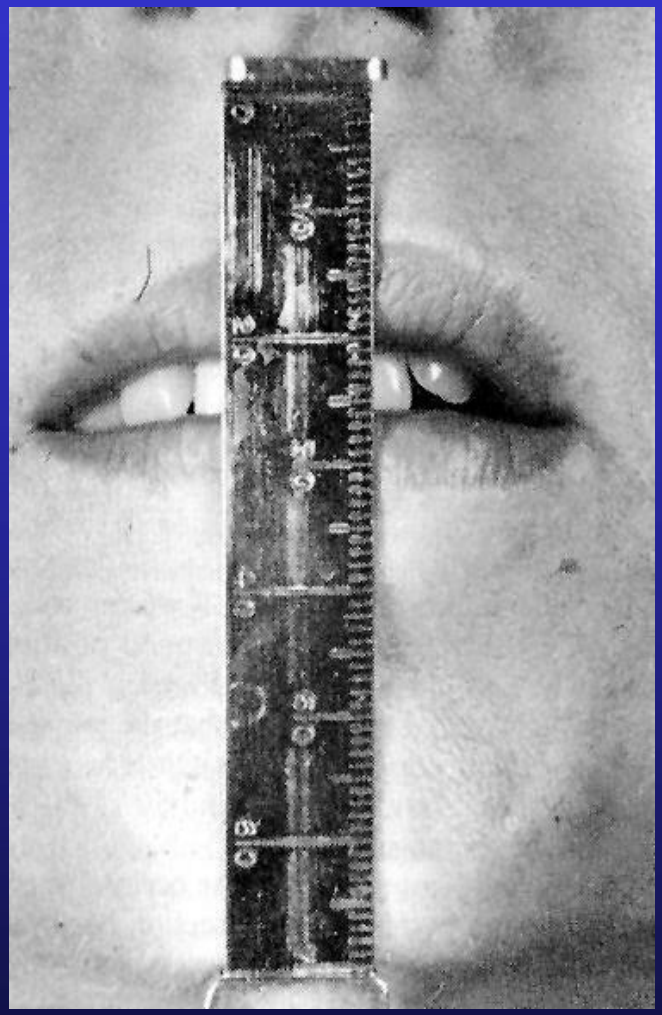
A=B

WILLIS gauge in position



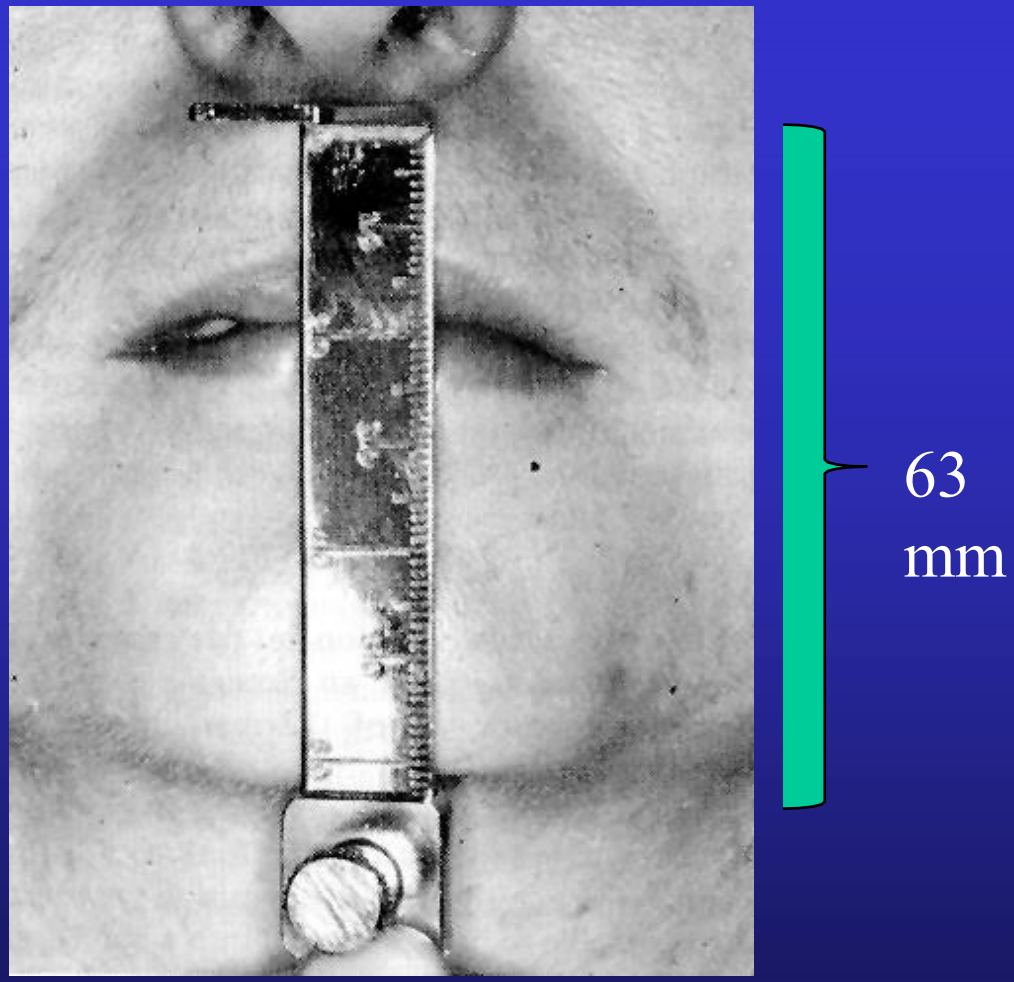
Nose chin measurement taken in mm

Willis gauge in position



The occlusal vertical dimension with the natural teeth present reads 70 mm

After extraction



After extraction of the teeth, the rest vertical dimension reads 63 mm a reduction of 7 mm from the natural occluding dimension. Rest dimensions in edentulous patients may not be the same as dentate patients.

5) Facial dimensions

- **McGee Method: correlated vertical dimension occlusion with three facial measurements.**
- **1) The distance of the centre of the eye to a line projected laterally to the median line of the lips is equal to :-**
- **2) The distance from the glabella to the subnasion and equal to :-**
- **3) The distance between the two angles of the mouth when lips are in repose.**
- **McGee states that two of these measurements will be invariably equal and equates to the vertical dimension of occlusion. 95% of patients with natural teeth exhibit this phenomena.**

6) Phonetics

- This theory is dependent upon the correlation that speech is related to the interocclusal distances between teeth or occlusal rims.
- The most popular sound is the use of the Labial “M” sound in aiding the rest position of the mandible.
- During this sound the upper and lower lip should just touch.
- The lips are parted and we can see a space between the teeth of occlusal rim.
- May be difficult to see. Thus some people use the letter “emma” where the lips will be parted.

7) Closest speaking space

Silverman,s technique.

- Say “ Missisippi “
- the lips are just parted and the space can be seen between the teeth.
- The phonetics method relies upon muscular phonetic control.
- Word like “S” “Yes” Missi”., Monday, Tuesday ,Wednesday quickly, Tuesday is the one wanted.
- 61,62….66 are said.
- 44 in hokkien

8) Swallowing threshold

- The position of the mandible at the beginning of the swallowing act has been used as a guide to the vertical dimension.
- Theory is that when one swallows, the teeth come together in light contact. This is used as the basis of obtaining the OVD.
- Use soft wax cones on the occlusal rims and ask patient to do repeated swallowing to gradually reduce the height of occlusion.
- To be accurate an estimate of the OVD should have been made and established earlier.

Swallowing technique to obtain OVD

Swallow raises the mandible and then stops at a height

9) Esthetic appearance in establishing VD

- Method based upon:
  - the esthetic harmony of the lower third of the face relative to the rest of the face.
  - the contours of the lip
  - the appearance of the skin from the margins of the lower lip to the lower border of the chin.
  - the labio mental angle.

10) Patients former dentures

- Compare the patients old denture's vertical height with the one obtained at the record making procedure.
- We can subtract or add on this vertical dimension depending on the status of the old denture
- If patients old denture is overclosed, ensure that our increase that we give is reasonable

Thank you for your attention!