Republic of Iraq
Ministry of Higher Education
and Scientific Research
University of Baghdad
College of Dentistry

Occlusion In Complete Denture

A Project Submitted to

The College of Dentistry, University of Baghdad, Department of Prosthodontic in Partial Fulfillment for the B.D.S.

By

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B.D.S., M.Sc.

2023 A.D. **1444 A.H.**

بسم الله الرحمن الرحيم

وأن ليس للإنسان إلا ما سعى

وأن سعيه سوف يرى

صدق الله العظيم

CERTIFICATION OF THE SUPERVISOR

I certify that this project entitled **"Occlusion In Complete Denture"** was prepared by the fifth-year student **Farah Ammar Majid** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Assist. Lec. Moamin Ibrahim Issa

April 2023

DEDICATION

Every challenging work needs self-effort as well as the guidance of elders, especially those who are very close to our hearts. My humble effort I dedicate to my sweet and loving family, who always picked me up on time and encouraged me to go on every adventure, especially this one.
My father has been the silent force behind my success. My mother has been a constant source of guidance in my career. My little sister, who is always there for me when I need her, is my best friend.

Furthermore, I would like to mention "Get a clear idea of what inspires you, dedicate your energies to its pursuit, and there is no knowing what you can achieve, particularly if others are inspired by your dream and offer their help".

Farah Ammar

ACKNOWLEDGMENT

In the Name of Allah, the Most Gracious, the Most Merciful.

First and foremost without question or hesitation, I must acknowledge my limitless thanks to ***Allah***, who has always been generous and kind, the Ever- Magnificent; the Ever-Thankful, for His help and bless.

I owe a deep debt of gratitude to our university for giving us an opportunity to complete this work. I would like to express my gratitude to **Prof. Dr. Raghad Al-hashimi,** Dean of College of Dentistry, University of Baghdad and **Prof. Dr. Abdel-bassit Fathallah** Head of Prosthetic Department for his continuous care.

I am especially thankful to my supervisor **Assist. lec. Moamin Ibrahim Issa,** for sharing his scholarly knowledge and experience, making suggestions, providing tips, and his hard work with invaluable support to give constant guidancein every step. Without whom I could not have accomplished this research, he is thekey person behind all my successful endeavors. I appreciate what you did. Thank you.

My warmest regards to **my family** for their enduring support and unforgettable sacrifices at all times

I would like to take this opportunity to thank all those people who, directly or indirectly were instrumental in successfully bringing out this graduation project. Last but not the least, I acknowledge all my friends and colleagues for their best wishes to boost my morale, helping and cheering me on in all my life.

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LIST OF ABBREVIATIONS

Abbreviation	Full Text
B.U.L.L.	Acronym for Buccal of the Upper, Lingual of the Lower (cusps)
BBO	Bilateral Balanced Occlusion
CC	Compensating Curve
CG	Condylar Guidance
CGO	Canine Guided Occlusion
CR	Centric Relation
ICP	Inter-Cuspal Position
IG	Incisal Guidance
LO	Lingualized Occlusion
PO	Plane of Occlusion
RCP	Retruded Contact Position
TMJ	Temporomandibular Joints

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INTRODUCTION

The word ‘Occlusion’ means a closure, which indicates a contact relationship of the teeth. In a broad sense, however, it represents a vast field of dentistry encompassing the study of all factors associated with jaw closure **(Sarandha, Hussain and Uthkarsh, 2007).**

Ideal occlusion is an occlusion compatible with the stomatognathic system providing efficient mastication and good esthetics without any physiologic abnormalities. Search for an ideal occlusion for complete denture fabrication has been going on for more than two centuries in an effort to find the tooth form that can provide maximum retention, stability and masticatory efficiency without compromising the health of the underlying tissues **(Ali and Hasan, 2020).**

The quality of occlusal contact relations are between the maxillary and mandibular dental arches allows for efficient mastication. In certain populations, masticatory function related to dental status is a significant determinant of nutritional status. Being an edentulous geriatric patient without complete dentures was shown to be an independent risk factor for malnutrition. This suggests the importance of functional occlusion **(Sivam and Chen, 2021).**

The role of occlusion is multifactorial toward the denture success–retention, support, stability and preservation of the residual ridge and surrounding tissues/muscles, and undoubtedly the esthetics. The denture behaves different than natural teeth as it acts as one unit, where the force applied to a single denture tooth gets passed on to the whole denture. The muscle attachments and functional and parafunctional movements have their role to play in the denture success **(Bhambhani *et al.*, 2020).**

Occlusion may be discussed from two viewpoints. It may be discussed in its static relations or in its dynamic relations. The static relations in occlusion are those which occur in the many possible contacts of teeth without the interposition of food. The dynamic or functional relations are those which occur opening and closing movements involved in the mastication of food **(Raghavan, Shajahan and Purushothaman, 2020).**

Bilateral balanced occlusion provides comfort for the patient, protects the tissues, and improves retention. Lingualized balanced occlusion also provides comfort, retention and is the occlusion choice for patients with residual ridge resorption. Monoplane posterior teeth are flat and were developed to minimize horizontal forces and improve stability **(Iegami *et al.*, 2016).**

Arrangement of artificial teeth plays a pivotal role in the success of complete denture fabrication. It is not a mechanical process performed on devices, but needs to be correlated with biologic factors, function and aesthetics **(Rangarajan and Padmanabhan, 2017).**

There are some factors pertaining to the functional harmony of the complete dentures, the most important of which are the occlusal surfaces. Any occlusal error such as premature contact or sliding will affect the denture's stability and retention, which in turn will hamper masticatory function, comfort and maintenance ofresidual ridge. Therefore, if the occlusal contacts are not even through the entire arch, the main goals of the prosthetic therapy will not be achieved **(Patel, Ponnanna and Tripathi, 2013; Abbasi *et al.*, 2021).**

AIMS OF THE REVIEW

1. The aim of this project is to have an overview on the occlusion and different occlusal concepts and occlusal schemes.
2. The review of the importance of using balanced occlusion in the review of complete dentures fabrication.

REVIEW OF LITERATURE

1.1 General terminology

a. Occlusion: It is the relationship between occlusal surfaces of upper and lower teeth when they are in contact. The term occlusion describes static contact between upper and lower teeth after jaw movement has stopped and opposing teeth contact.

b. Centric occlusion: The occlusion of opposing teeth when the mandible is in centric relation; this may or may not coincide with the maximal intercuspal position.

c. Centric jaw relation: This is an antroposterior bone-to-bone relation between the mandible and the maxilla that can be defined as, "the rearmost, midmost and uppermost untranslated hinged position of the condyles". It is a strained relation that can be statically repeated.

Or "The most posterior relation of the mandible to the maxillae at the established vertical dimension" **(GPT-9, 2017).**

d. Maximal intercuspal contacts: Tooth contact in the maximal intercuspal position.

e. Maximal intercuspal position: The complete intercuspation of the opposing teeth independent of condylar position, sometimes referred to as the best fit of the teeth regardless of the condylar position.

f. Eccentric occlusion: An occlusion other than maximal intercuspal position.

g. The working Side: It is the side on which the chewing is done at the movement.

h. The balancing side: It is the side opposite to the working side, on which there is still at least one point of contact between the upper and lower teeth **(GPT-9, 2017).**

i. Articulation: The static and dynamic contact relationship between the occlusal surfaces of the teeth during function.

j. Occlusal plane: It is an imaginary plane that is related anatomically to thecranium and theoretically touches the incisal edges of the incisors and the tips of theocclusal surfaces of the posterior teeth. It is not a plane in the true sense of the wordbut represents the mean of the curvature of the surface. The surface of wax occlusion rims contoured to guide in the arrangement of denture teeth.

k. Occlusal disharmony: A phenomenon in which contacts of opposing occlusal surfaces are not in harmony with other tooth contacts and/or the anatomic and physiologic components of the craniomandibular complex **(GPT-9, 2017; Mostafa, 2011).**

1.2 Mandibular Movement

Recordings of mandibular movements are considered important in establishing occlusion. Mandibular movement occurs in three dimensions and is extremely complex. Temporomandibular joint, anterior and posterior muscles, and the neuromuscular system govern mandibular motion **(Chou and Pameijier, 1987).**

As for any other movement in space, complex three-dimensional mandibular movement can be broken down into two basic components: translation, when all points within a body have identical motion, and rotation, when the body is turning about an axis. Every possible three dimensional movement can be described in terms of these two components. In addition, it is easier to understand mandibular movement when the components are described as projections in three perpendicular planes: sagittal, horizontal, and frontal (Figure 1.1 A and B) **(Rosenstiel, Land and Fujimoto, 2016).**

1.2.1 Reference planes

1.2.1.1 Sagittal plane

In the sagittal plane, the mandible is capable of a purely rotational movement as well as translation (Figure 1.1 A and B). Rotation occurs around the

terminal hinge axis, an imaginary horizontal line through the rotational centers of the left and right condylar processes. The rotational movements limited to about 12 mmof incisor separation before the temporomandibular ligaments and structures anterior to the mastoid process force the mandible to translate. During translation, the lateral pterygoid muscle contracts and moves the condyle-disk assembly forward along the posterior incline of the tubercle. Condylar movement is similar during protrusive mandibular movement **(Rosenstiel, Land and Fujimoto, 2016).**

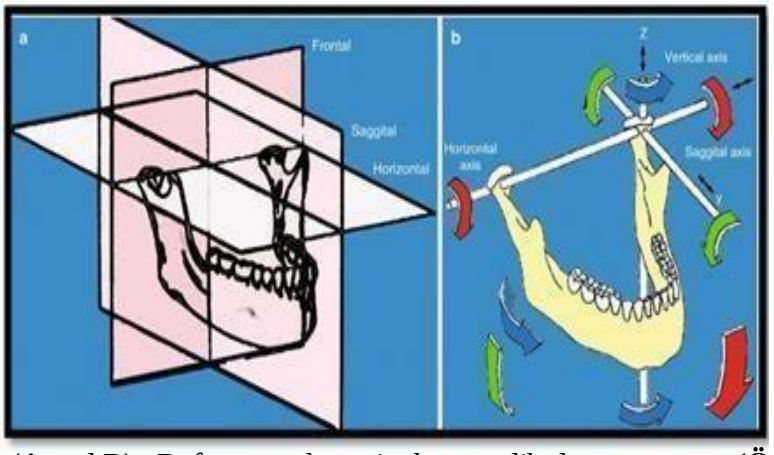

Figure (1.1) (A and B): Reference planes in the mandibular movement **(Ö zkan, 2018).**

1.2.1.2 Horizontal plane

Horizontal axis: Movement occurs in a sagittal plane when mandible makes a purely rotational opening and closing movement around the terminal hinge axis passing through both the condyles. This type of movement is called a hinge movement. This type of movement occurs till about 20–25 mm of separation in the anterior teeth and beyond it translatory movement occurs **(Prakash and Gupta, 2017).**

The transverse axis runs horizontally from the right side of the mandible to the left. Rotation around this axis is seen during protrusive movement. The transverse axis of rotation varies during different phases of protrusive movement. During initial mouth opening, the transverse axis passes through the head of the condyle. During the later stages of mouth opening, the transverse axis passes through the mandibular foramen (Figure 1.1 A and B) **(Rao, 2015; Nallaswamy, Ramalingam and Bhat, 2003).**

1.2.1.3 Frontal plane

Movement occurs in the frontal plane when the mandible moves laterally. The nonworking or balancing condyle moves down and medially, whereas the working condyle rotates around the sagittal axis perpendicular to this plane **(Prakash and Gupta, 2017).** This movement, in the sagittal plane, happens when the mandible in centric relation makes a purely rotational opening and closing border movement around the transverse horizontal axis, which extends through both condyles (Figure **1.1** A and B) **(Shillingburg *et al.*, 2012).**

1.3 Differences between natural and artificial occlusion

Denture Occlusion being different from natural tooth occlusion requires dealing with many compromising factors:

a. Unequal surface areas of maxillary and mandibular arches causing stability issues.

b. Changes in the denture base area due to continuous, lifelong bone resorption process **(Jain, 2017).**

Most principles of occlusion are applied for both dentulous and edentulous patients, however, some principles of occlusion may vary in complete denture occlusion due to differences between natural and artificial dentition. These are:

Table 1_1: Differences between natural and artificial teeth **(Nallaswamy, 2017).**

Natural teeth[47]	*Artificial teeth*
• Natural teeth function independently and each individual tooth disperses the occlusal load	• Artificial teeth function as a group and the occlusal loads are not individually managed
• Malocclusion can be non-problematic for a long time	• Malocclusions pose immediate drastic problems
• Nonvertical forces are well tolerated	• Nonvertical forces damage the supporting tissues
• Incising does not affect the posterior teeth	• Incising will lift the posterior part of the denture

• The second molar is the favored area for heavy mastication for better leverage and power	• Heavy mastication over the second molar can tilt or shift the denture base
• Bilateral balance is not necessary and usually considered a hindrance	• Bilateral balance is mandatory to produce stability of the denture
• Proprioceptive impulses give feedback to avoid occlusal prematurities. This helps the patient to have a habitual occlusion away from centric relation	• There is no feedback and the denture rests in centric relation. Any prematurities in this position can shift the base

1.4 Ideal requirements of complete denture occlusion

Complete denture occlusion should fulfil the following characteristics:

1. Cutting and shearing efficiency of incisal and occlusal surfaces with sluiceways for escape of food.
2. Minimal areas of contact for reduced force on ridges during mastication.
3. Favourable tooth-to-ridge crest position for functional lever balance.
4. Reduced posterior cusp height to control horizontal forces.
5. Reduced buccolingual width of posterior teeth to decrease forces transmitted to residual ridge.
6. Should have a surface to direct the forces of occlusion vertically.
7. Occlusal forces should be directed towards the anteroposterior centre of the ridges.
8. Occlusal plane parallel to the mean foundation plane.
9. No anterior teeth contact except during protrusion by providing adequate vertical and horizontal overlap and flat incisal guidance.
10. Stability of the denture and its occlusion in both centric and eccentric relations **(Rangarajan and Padmanabhan, 2013).**

1.5 Theories of occlusion

1.5.1 Bonwill theory

In 1858 an American dentist, G Bonwill described an equilateral triangle, which was the basis for Bonwill's theory of occlusion. The equilateral triangle had 100mm [4inches] formed by lines joining the medial contact point of the incisors and the centers of the mandibular condyles (Figure 1.2) **(Nikolopoulou *et al.*, 2019).**

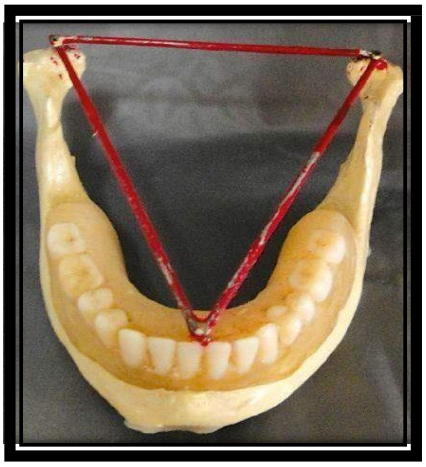

Figure (1.2): Bonwill theory **(Rangarajan and Padmanabhan, 2017).**

1.5.2 Conical theory articulators (proposed by RE Hall)

The conical theory of occlusion proposed that the lower teeth move over the surfaces of the upper teeth as over the surface of a cone, generating an angle of 45-degrees with the central axis of the cone tipped 45°to the occlusal plane (Figure 1.3) **(George, 2006; Sarandha, Hussain and Uthkarsh, 2007; Nallaswamy, 2017).**

The teeth of the maxillary denture would conform to a segment of the inner surface of an 8-inch cone. Proposed by Hall in 1915. The Hall articulator is based on this theory **(Rangarajan and Padmanabhan, 2017).**

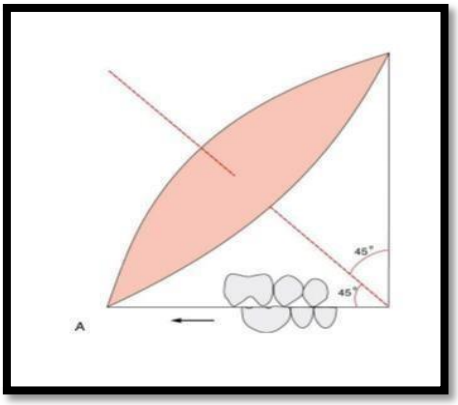

Figure (1.3): Conical theory **(Rangarajan and Padmanabhan, 2017).**

1.5.3 Spherical theory (Monson)

This was proposed by Monson in 1918 based on the observations of natural teeth and skulls made by Von Spee, an anatomist. (Figure 1.4) shows that the lower teeth move over the surfaces of the upper teeth as over the surface of a sphere witha diameter of 8 inches (20 cm). The center of the sphere is located in the region of the glabella and the surfaces of the sphere passes through the glenoid fossa along the articulating eminences or concentric with them, e.g. Monson's maxillomandibular articulator **(George, 2006; Sarandha, Hussain and Uthkarsh,2007).**

It involves positioning of teeth with anterior-posterior and medio-lateral inclines in harmony with the spherical surface. It is sometimes referred to as having Monson curve. This occlusion must be developed in curved form, the arc plane having its convex face downwards and its concave surface upwards **(Sarandha, Hussain and Uthkarsh, 2007)..**

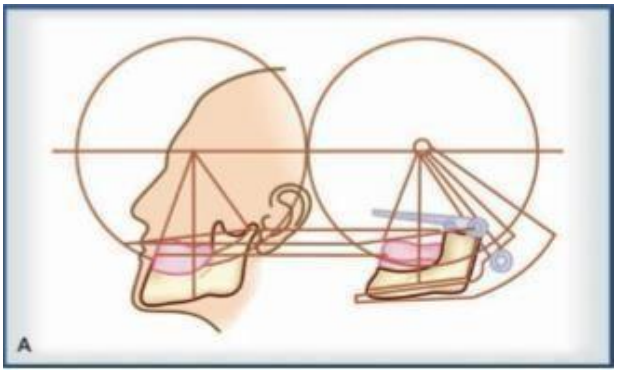

Figure (1.4): Spherical theory **(Sarandha, Hussain and Uthkarsh, 2007).**

1.5.3.1 Disadvantages of spherical theory

1. Forces delivered at right angles to occlusal plane will cause increased stress due to butting action. Forces against the lower denture will drive it to one side against the poorly formed and sensitive tissues of mylohyoid ridge
2. Articulators based on this theory do not have provisions for variations ininclinations for condylar paths.

3. It cannot be used in all patients due to variation in the paths of jaw movements **(Sarandha, Hussain and Uthkarsh, 2007; Nallaswamy, Ramalingam and Bhat, 2003).**

1.6 Occlusal schemes

Occlusal scheme is defined as the form and the arrangement of the occlusal contacts in natural and artificial dentition. The choice of an occlusal scheme will determine the pattern of occlusal contacts between opposing teeth during centric relation and functional movement of the mandible. With dentures, the quantity andthe intensity of these contacts determine the amount and the direction of the forcesthat are transmitted through the bases of the denture to the residual ridges. That is why the occlusal scheme is an important factor in the design of complete dentures

(Tarazi and Ticotsky, 2007).

The harmony of occlusal contacts is an important factor in determining the relationship between complete denture and the stomatognathic system. Studies have shown that the choice of occlusal scheme is necessary for denture stability and patient satisfaction. The occlusal scheme should be chosen based on the patient's age, the height and width of residual ridge, the presence of parafunctional habits, underlying systemic conditions, neuromuscular disorders, aesthetic demand, etc **(Abbasi *et al.*, 2021).**

Morphologically teeth can be classified as:i.Cusp Teeth (Figure 1.5)

a. Anatomic Teeth

b. Semi-Anatomic Teeth

ii.Cuspless Teeth (Figure 1.5) **(Rao, 2015; Nallaswamy, 2017).**

Figure (1.5): Artificial posterior teeth (A) Zero degree teeth (B) 10° cusps (C)Anatomical teeth **(Klineberg and Eckert, 2016).**

1.6.1 Cusp teeth

They have cusps and fossae-like natural teeth. They are of two types: (Rao, 2015).

1.6.1.1 Anatomic teeth

It is defined as, "Teeth that have prominent cusps on the masticating surfaces and that are designed to articulate with the teeth of the opposing natural or prosthetic dentition" **(GPT-9, 2017).**

An anatomic tooth is one that is designed to simulate the natural tooth form. The standard anatomic tooth has inclines of approximately 33°or more and somewhat resembles natural teeth (Figure 1.6). Anatomic teeth allow balanced occlusion to be more readily obtained because of the cusp length **(Hassaballa, 2010).**

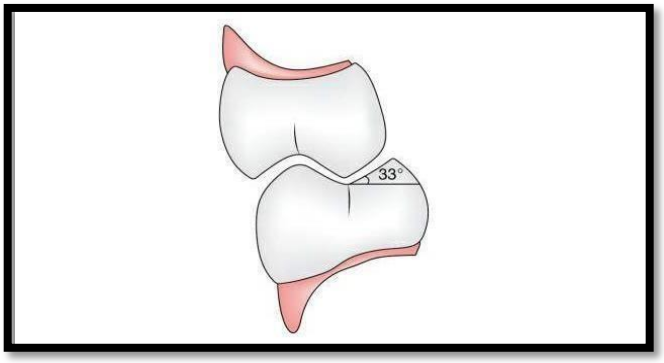

Figure (1.6): Cusp tooth (angulation of 33^{o}) **(Rangarajan and Padmanabhan,2017).**

Cusp inclination is measured by an angle formed by the mesio-buccal cusp incline in relation to the horizontal plane when the tooth is in vertical relation to the horizontal plane. The inclined planes of artificial teeth should be in harmony with the inclination of the TMJ so that eccentric occlusal contact would be in harmony with mandibular movements of denture wearers. Thus, with the use of anatomic teeth, it is mandatory to register protrusive and lateral records and to use adjustablearticulators in an attempt to produce free gliding occlusion without deflective occlusal contacts and thus obtain stable dentures **(Mostafa, 2011).**

I. Advantages of anatomic teeth

1. Closely resembles natural teeth – highly aesthetic.
2. Proper contours for crushing and triturating.
3. Presence of adequate sluiceways.
4. Greater chewing efficiency, excessive chewing pressure is minimized.
5. More vertical chewing stroke.

6. Cuspal inclines provide a depth to obtain eccentric balance.
7. Provides a greater resistance to rotation of dentures.
8. Provides a comfortable position to return to when cusps are making contact in fossae **(Mostafa, 2011).**

II. Disadvantages of anatomic teeth

1. More difficult and time consuming to obtain balanced occlusion.
2. Settling (stabilization of occlusion) results in more damaging interferences.
3. Possibilities of more lateral (horizontal) stress in function **(Nallaswamy, Ramalingam and Bhat, 2003).**

1.6.1.2 Semi-anatomic teeth

These teeth have cusp angles ranging between 0°and 30°. The cusp angles are usually around 20°. They are also called modified anatomic teeth. They are used in cases with mild discrepancies in jaw relation. They are more flexible to arrange than anatomic teeth but they are not as flexible as non-anatomic teeth **(Nallaswamy, 2017).**

They are also known as modified-cusp or low-cusp teeth. 10°semi-anatomic teeth are commonly known as functional or anatoline teeth. They are used in cases with mild discrepancies in jaw relation **(Nallaswamy, Ramalingam and Bhat, 2003).**

I. Advantages of semi-anatomic teeth

1. Easier to arrange and obtain balanced occlusion.
2. Can provide freedom if settling occurs.
3. Reduction of lateral stresses.
4. Provides all the advantages of cusp teeth **(Rao, 2015).**

II. Disadvantages of semi-anatomic teeth

1. Less aesthetic (buccal cusps are shorter).
2. Less chewing efficiency (controversial: some claim greater) **(Nallaswamy, 2017).**

1.6.2 Cuspless teeth (non-anatomic teeth)

Non-anatomical teeth are defined as, "Artificial teeth with occlusal surfaces that are not anatomically formed; the term non-anatomic as applied to artificial posterior teeth, and especially their occlusal forms" **(GPT-9, 2017).**

These are also called 'cuspless', 'monoplane' or 'zero degree' teeth. The occlusal surface is essentially flat and has no cusp heights **(Rangarajan and Padmanabhan, 2017).**

Non-anatomical teeth are designed with flat occlusal surfaces and allow even contact without deflection during excursive movement. They can be used with the monoplane occlusal scheme described earlier, and the teeth can also be set up on a simple hinge articulator **(Allen and McCarthy, 2003).**

They have no cuspal angulation hence are very flexible to set. It is easy to set non-anatomic teeth in balanced occlusion **(Nallaswamy, Ramalingam and Bhat, 2003).**

1.6.2.1 Advantages of cuspless teeth

1. Simplest of all recordings, simplest articulator, quick arrangement of teeth.
2. Wide range of posterior at plane tooth positions.
3. No lateral stresses on mucosa with parafunction.
4. Easier for patients with uncoordinated closures (e.g., patients with dyskinesias, Parkinson's disease, or stroke).
5. They offer less resistance to horizontal forces thereby causing less damage to the ridges in the following conditions:
   a. Bruxism
   b. Poor residual ridges
   c. Malrelated jaws – class II and class III
   d. Uncoordinated neuromuscular controls
6. They give the patient a sense of freedom as they do not lock the mandible in one position only.

7. They eliminate horizontal forces that may be more damaging than vertical forces (less bone resorption).
8. Balance obtained by balances ramp, compensating curve or pleasure curve **(Mostafa, 2011; Zarb, 2013; Rangarajan and Padmanabhan, 2017).**

1.6.2.2 Disadvantages of cuspless teeth

1. Flat occlusal surfaces and artificial contours give an unaesthetic appearance.
2. Masticatory efficiency is less.
3. Balanced occlusion cannot be obtained.
4. Any attempt to correct these teeth by occlusal grinding will decrease their efficiency **(Nallaswamy, Ramalingam and Bhat, 2003).**

1.7 Concepts of occlusion

The denture acts as one unit, and any force applied to a single denture tooth will be directly transferred to the rest of the denture.To overcome this limitation, several occlusal concepts for complete dentures have emerged. Altering the posterior tooth morphology and occlusal scheme has been suggested to impact the lateral forces on the denture and residual ridge. It has been argued that any occlusal force applied to one segment of the denture must be balanced by force applied to the other denture segment, ie, balanced occlusion. In contrast, some authors have proposed the use of flat teeth to minimize lateral forces and enhance denture stability.

This principle is justified from a mechanical perspective; however, it is not necessarily justified from biologic and physiologic perspectives **(Abduo, 2013).**

1.7.1 Lingualized occlusion

It was first proposed by Alfred Gysi in 1927. The LO concept utilizes anatomic teeth for maxillary denture with prominent palatal cusps and modified, non-anatomic or semi-anatomic teeth for mandibular denture (Figure 1.7). Clough reported that 67% of the patients preferred lingualized occlusion due to its superior chewing efficiency **(Sarandha, Hussain and Uthkarsh, 2007).**

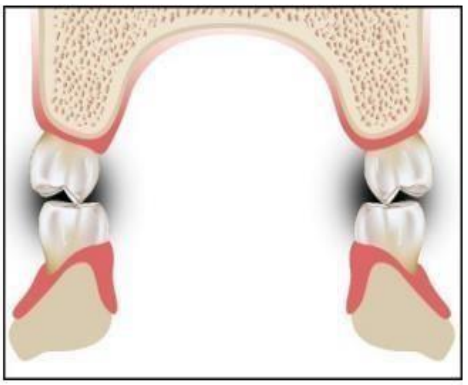

Figure (1.7): Teeth arrangement in dentures with lingualized occlusion **(Ali and Hasan, 2020).**

Lingualized occlusion it is a form of denture occlusion in which the maxillary lingual cusps articulates with the mandibular occlusal surfaces in centric occlusion, working and nonworking mandibular position. Only lingual cusps are kept in contact which reduces the potentially damaging lateral forces. Lingualized occlusion offers improved denture stability and patient comfort **(Abbasi *et al.*, 2021).**

Lingualized occlusion is a modification of the balanced occlusion. This differs in that the artificial teeth are designed to have fewer inter-cuspal position (ICP) contacts while still distributing the occlusal load centrally over the alveolar ridge. Similarly, when moved into lateral excursions, there is only one contact between the palatal cusp of the upper teeth and the buccal and lingual cusps of the lower teeth. To ensure the single contacts produce a stable denture, the occlusal contacts are positioned directly over the mandibular alveolar ridge, resulting in a narrower distribution of contacts and pressure, directed centrally over the ridges, compared to that seen when using natural occlusion teeth **(Johnson and Wood, 2012).**

1.7.1.1 Advantages of lingualized occlusion

1. Good esthetics
2. Good bolus penetration
3. Simple technique
4. Additional stability in parafunction

5. Reduced lateral forces directed toward alveolar ridges
6. Ease of adjustment
7. An area of closure provided that better accommodates
8. basal seat changes
9. More easily used in Class II, Class III, and cross-bite situations
10. Compatible with the tenets of neutrocentric occlusion **(Engelmeier and Phoenix, 2017).**

1.7.1.2 Disadvantages of lingualized occlusion

1. It is less natural than the cusp tip to fossa occlusion.
2. It results in decreased masticatory efficiency as maxillary buccal cusp does not contact the mandibular teeth.
3. When flat teeth are used in maxillary arch, the lingual occlusion seems unaesthetic **(Sabir, Regragui and Merzouk, 2019; Prakash and Gupta, 2017).**

1.7.2 Neutrocentric occlusion (monoplane occlusal scheme)

In 1954, De van formalized guidelines for using flat teeth in flat occlusal surfaces. The term "neutrocentric" is suggested to denote a concept embodying two key objectives in the making of a denture: (1) neutralization of inclines and (2) centralization of occlusal forces acting on the denture foundation **(Raghavan, Shajahan and Purushothaman, 2020).**

The term neutrocentric denotes an occlusion that eliminates the anteroposterior and buccolingual inclines in order to direct the forces to the posterior teeth **(Nallaswamy, Ramalingam and Bhat, 2003).**

1.7.2.1 The factors involved in the relation of the teeth to the denture foundations

1. Position (centralized): Position teeth in as central a position in relation to the denture foundation as permitted by the tongue to provide greater stability for the denture **(Prasad, Prakash and Jason, 2012).**

2. Proportion: Reduction of tooth width up to 40%. Reduced vertical stress on the ridge by narrowing the occlusal table. Forces were centralized without encroachment on the tongue space **(Prasad *et al.*, 2013).**

3. Pitch (inclination): There was no compensating curve and no incisal guidance. This positioning directed forces perpendicular to the mean osseous foundation plane **(Prasad *et al.*, 2013).**

4. Form: Tooth form was modified using flat teeth with no deflecting inclines. This arrangement reduced destructive lateral forces and to direct the masticatory forces perpendicular to the support. All contacts were in a single plane with no projections above or below the plane to interfere with the mandibular movements **(Rangarajan *et al.*, 2016).**

5. Number: The posterior teeth were reduced in number from 8 to 6. This decreased the magnitude of the occlusal force and centralized it to the second premolar and first molar area **(Rangarajan *et al.*, 2016; Prasad *et al.*, 2013).**

1.7.2.2 Advantages of neutrocentric occlusion

1. It is more adaptable to the unusual jaw relation such as class II and class III relations, used easily in cases of variations in the width of maxillary and mandibular jaws, cross bite.
2. It provides freedom in occlusion.
3. It is useful in cases of poor ridges.
4. It is a simplified and less time-taking technique.
5. It centralizes the masticatory force.
6. It generates less pressure transmission than cusped teeth.
7. Easy to arrange the teeth.
8. Simple nonadjustable articulator is sufficient.
9. Easier occlusal scheme to achieve especially in the following conditions:
   a. Difficult to obtain accurate centric relation records (muscle incoordination)
   b. Skeletal malocclusion

c. Severe residual ridge resorption **(Prakash and Gupta, 2017; Sabir, Regragui and Merzouk, 2019; Rangarajan and Padmanabhan, 2017).**

1.7.2.3 Disadvantages of neutrocentric occlusion

1. The greatest criticism of this occlusal scheme is that it is the least esthetic as there is no incisal overlap and no posterior cusps.
2. Moving the teeth lingually and altering their vertical position may not be compatible with the tongue, lip, and cheek function. This is offsetted by narrowing of the tooth width.
3. The flat nature of teeth results in impaired mastication.
4. No vertical component to aid in shearing during mastication.
5. Patients may complain of lack of positive intercuspation position.

6. Occlude only in two dimensions, but the mandible has a 3D movement due to its condylar behavior **(Rangarajan *et al.*, 2016; Razzaque *et al.*, 2017).**

1.7.2.4 Balance occlusion for monoplane scheme

It can be accomplish by:

1. Compensatory curve
2. Tilting the second molars

3. Placing the balancing ramp or tooth at the distal part of the mandibular arch which comes in contact only in eccentric excursions (Figure 1.8) **(Sarandha, Hussain and Uthkarsh, 2007; Prasad *et al.*, 2013).**

Figure (1.8): Monoplane occlusal scheme (The ramp posterior to the 2nd molar) **(Jain, 2017).**

1.7.3 Balanced occlusion

It is defined as, "The simultaneous contacting of the maxillary and mandibular teeth on the right and left and in the posterior and anterior occlusal areasin centric and eccentric positions, developed to lessen or limit tipping or rotating ofthe denture bases in relation to the supporting structures" **(Rao, 2015).**

It is unique in complete dentures and does not occur with natural teeth. If it occurs in natural teeth, it is considered to be a premature contact on working side and is considered pathologic. Usually, anatomic teeth are used to arrange teeth in balanced occlusion. Nonanatomical teeth can be used with balancing ramps **(Rangarajan *et al.*, 2015; Raghavan, Shajahan and Purushothaman, 2020).**

1.7.3.1 Advantages of balanced occlusion

1. Improved masticatory efficiency.
2. Wide distribution of occlusal load- thus reducing trauma to tissues.
3. Multipoint contacts of teeth.
4. Bilateral simultaneous contact help to seat the denture in a stable position during mastication, swallowing and maintain retention and stability of the denture and the health of the oral tissues.
5. Due to cross-arch balance, as the bolus is chewed on one side, the balancing cusps will come close or will contact on the other.
6. Denture bases are stable even during bruxing activity **(Soratur, 2006; Prasad *et al.*, 2013).**

1.7.3.2 Disadvantages of balanced occlusion

1. It may tend to encourage lateral and protrusive grinding, although this may be confined to people who are subjective to irrelevant muscle activity.
2. A semi-adjustable or fully adjustable articulator is mandatory.
3. Difficult in Class II cases.
4. Procedures are much more complex and time consuming **(George, 2006; Sarandha, Hussain and Uthkarsh, 2007).**

1.7.3.3 Types of balanced occlusion

I. Unilateral balanced occlusion

This is a type of occlusion seen on occlusal surfaces of teeth on one side when they occlude simultaneously with a smooth, uninterrupted glide. This is not followed during complete denture construction. It is more pertained to fixed partialdentures **(Nallaswamy, Ramalingam and Bhat, 2003).**

II. Bilateral occlusal balance

Bilateral Balanced Occlusion (BBO) is an artificial occlusion; occurs when all the posterior teeth makes bilateral, simultaneous contact in inter-cuspal position and their continuous contacts during movements from centric jaw relation along specific working, balancing, and protrusive guidance pathways developed on the occlusal surface of the teeth within the normal range of mandibular function (figure 1.9). Researchers argue that bilateral balanced occlusion is important for retention, stability, support and it also increases masticatory efficiency. Though some authors disagree and state that there is no clinical evidence to support this **(Abbasi *et al.*, 2021; George, 2006; Ali and Hasan, 2020).**

Bilateral balanced occlusion in complete dentures is a preferred occlusal scheme that approved for setting denture teeth for the conventional complete dentures. It helps to reserve the supporting residual alveolar ridge and improve stability of dentures and provides teeth contacts at both sides working and balancing sides, at the same time with and allows better distribution of masticatory forces **(Patel, Ponnanna and Tripathi, 2013; Abdeen, Shaker and Elsaadany, 2022).**

This type of occlusion is the most desired one in complete denture fabrication. In this, minimum of three contacts are needed to establish a plane of equilibrium **(Prakash and Gupta, 2017).**

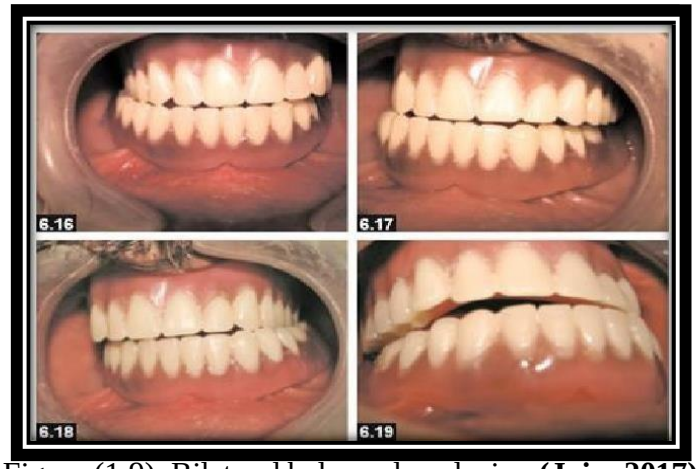

Figure (1.9): Bilateral balanced occlusion **(Jain, 2017).**

III. Protrusive occlusal balance

This type of balanced occlusion is present when mandible moves in a forward direction and the occlusal contacts are smooth and simultaneous anteriorly and posteriorly. There should be at least three points of contact in the occlusal plane. Two of these should be located posteriorly and one should be located in the anterior region. This is absent in natural dentition **(Nallaswamy, Ramalingam and Bhat, 2003; Prasad *et al.*, 2013).**

1.7.3.4 Factors influencing balanced occlusion

These factors are stated by Hanau and are exemplified in the Hanau's quint. The inclination of condylar guidance and inclination of incisal guidance control the movements of the articulator and are the end controlling factors, with condyles at one end and the incisal edges at the other end. The orientation of occlusal plane, inclination of the cusp and prominence of compensating curve may be changed by the dentist to attain harmony among all five factors **(Sarandha, Hussain and Uthkarsh, 2007).**

In terms of complete denture construction, with the exception of the condylar guidance angle is generated by the patient, all of these factors are under the clinician's control **(Davis, 2004; Sarandha, Hussain and Uthkarsh, 2007).**

The five factors in a Hanau's quint, it is still considered as the basic determinant of balanced occlusion **(Nallaswamy, Ramalingam and Bhat, 2003).** They are:

I. Condylar guidance (posterior determinant)

CG can be defined as, "Mandibular guidance generated by the condyle and articular disc traversing the contour of the glenoid fossa".

Or "The mechanical form located in the upper posterior region of an articulator that controls movement of its mobile member" **(GPT-9, 2017).**

It is nothing but the path of movement taken by the condyle in the glenoid fossa. The slope of the glenoid fossa is a 'S' bend. Hence the condyle also moves along a 'S' shaped path. This shape of the glenoid fossa, which determines the path of movement of the condyle (Figure 1.10). The condylar guidance can be measured using a protrusive interocclusal record **(Nallaswamy, Ramalingam and Bhat, 2003).**

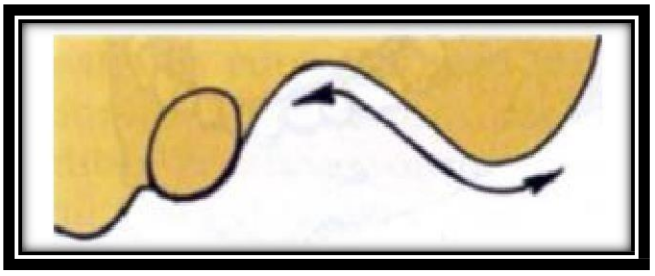

Figure (1.10): The slope of the articular eminence forms the condylar guidance **(Nallaswamy, Ramalingam and Bhat, 2003).**

A steep condylar guidance will cause greater posterior tooth separation in protrusion and requires teeth with longer cusps and flatter fossa to achieve balanced occlusion, than a shallow guidance (Figure 1.11) **(Rangarajan and Padmanabhan, 2017).**

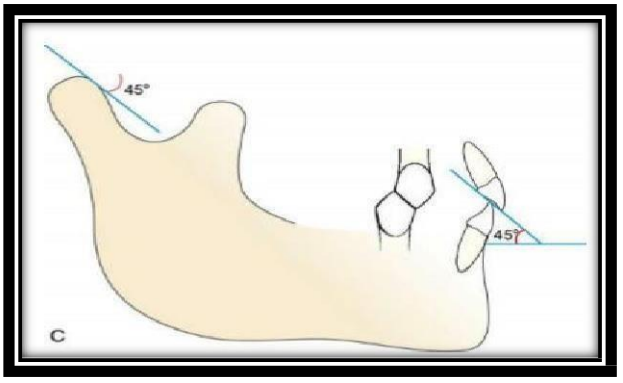

Figure (1.11): Steep CG requires longer cusps and flatter fossa to achieve balancedocclusion **(Rangarajan and Padmanabhan, 2017).**

II. Incisal guidance (anterior determinant)

IG is defined as, "The influence of the contacting surfaces of the mandibular and maxillary anterior teeth on mandibular movements" **(GPT-9, 2017).**

The incisal angle is the angle formed by a line joining the incisal edges of upper and lower incisors and a line representing the horizontal plane (Figure 1.12) **(Mostafa, 2011).**

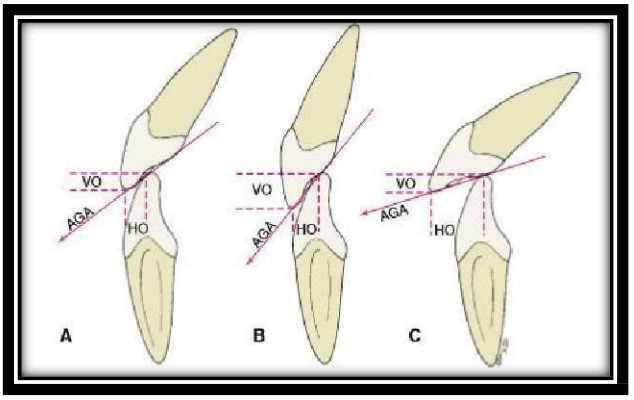

Figure (1.12): Incisal guidance **(Rosenstiel, Land and Fujimoto, 2016).**

The incisal guidance is absent in a completely edentulous patient. It is reproduced in the complete denture by arbitrarily setting the anteriors using a standard incisal guide value and modifying them to suit the patient during aesthetic anterior try-in **(Nallaswamy, Ramalingam and Bhat, 2003).**

It is established during try-in. If this angle is steep, it requires steep cusps, steep occlusal plane and a steep compensating curve to obtain occlusal balance. This is detrimental to denture stability. Hence, it should be as flat (close to zero degrees) as aesthetics and phonetics will permit **(Rangarajan and Padmanabhan, 2017).**

III. Plane of occlusion (PO)

It is defined as, "An imaginary surface which is related anatomically to the cranium and which theoretically touches the incisal edges of the incisors and the tips of the occluding surfaces of the posterior teeth. It is not a plane in the true sense of the word but represents the mean curvature of the surface" **(GPT-8, 2005).**

It is established anteriorly by the height of the lower canine, which nearly coincides with the commissure of the mouth and posteriorly by the height of the retromolar pad. It is usually parallel to the ala-tragus line or Camper's line. It can be

slightly altered and its role is not as important as other factors. Tilting the plane of occlusion beyond 10 º is not advisable **(Nallaswamy, Ramalingam and Bhat, 2003).**

If the orientation of the occlusal plane is incorrect, then this will impact upon appearance and possibly cause occlusal interferences. The orientation of the plane is determined when shaping the wax occlusal rims during the jaw registration stage and is checked at the trial denture stage **(Davis, 2004).**

IV. Cuspal height and inclination

Cuspal inclination: It is defined as the angle made by the average slope of a cusp with the cusp plane measured mesiodistally or buccolingually. It is also called 'cusp angle'. It has effects on the occlusal plane and the compensating curves **(Rao, 2015).**

According to Hanau, artificial dental cusps height may vary according to the inclination of the condylar guidance. The higher the inclination of the condylar guidance is, the higher the artificial teeth cusps can be. Height of cusps also improves esthetics and may please the patient, since they are similar to natural teeth **(Iegami *et al.*, 2016).**

V. Compensating curve (CC)

The anteroposterior curving (in the median plane) and the mediolateral curving (in the frontal plane) within the alignment of the occluding surfaces and incisal edges of artificial teeth that is used to develop balanced occlusion (Figure 1.13 A and B) **(GPT-9, 2017).**

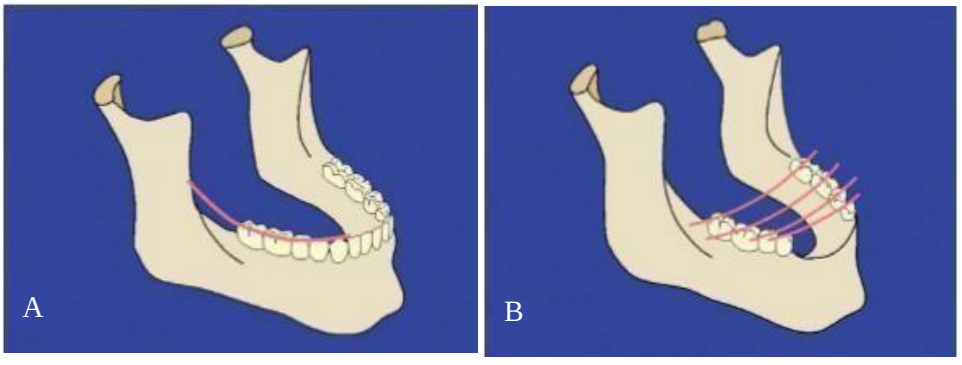

Figure (1.13): Compensating curve (A) Curve of Spee (B) Curve of Wilson **(Hassaballa, 2010).**

The form of the compensating curve is entirely under the control of the dentist. The value of the compensating curve is that it allows the dentist to alter the effective cusp angulation without changing the form of the manufactured teeth. Byinclining the long axes of the teeth, the dentist is able to arrange the cusp angulations so that they harmonize with the end controlling factors; namely the condylar guidance and the incisal guidance and create a balanced occlusion **(Hassaballa, 2010).**

There are two types of compensating curves, namely:

a. Anteroposterior compensating curves. b. Lateral compensating curves.

Curve of Spee, Wilson's curve, and Manson's curve are associated with natural dentition. In complete dentures, compensating curves similar to these curves shouldbe incorporated to produce balanced occlusion **(Rao, 2015).**

1.7.4 Canine guided occlusion (CGO)

One of the recently introduced concept in complete denture occlusion is Canine-guided occlusion. It is a form of mutually protected articulation in which the vertical and horizontal overlap of the canine teeth disocclude the posterior teeth in the excursive movements of the mandible. Like bilateral balanced occlusion, canineguided occlusion involves simultaneous contact on both sides in centric occlusion but there are differences in eccentric movement. Recent studies have shown that compared to bilateral balanced occlusion, it has an easier and faster set-up with the same masticatory efficiency but better clinical performance **(Abbasi *et al.*, 2021).**

1.8 Articulator and Face-bow

In prosthodontics, while we attempt to restore or replace missing teeth, it becomes imperative to mount patients' maxillomandibular relation on an articulatorwithmaxillary and mandibular casts, oriented to the hinge axis, for laboratory procedures **(Murakami *et al.*, 2019).**

Balanced Occlusion is a multipoint contact relationship of opposing teeth in a static condition. Occlusion however is a static relationship, but the oral cavity is dynamic and dynamic relationship between teeth is called articulation. Thisnecessitates balanced articulation and occlusion **(Soratur, 2006).**

Articulator: a mechanical instrument that represents the temporomandibular joints and jaws, to which maxillary and mandibular casts may be attached to simulate some or all mandibular movements (Figure 1.14). Articulators are divisible into four classes:

a. Class I articulator: A simple holding instrument capable of accepting a single static registration; vertical motion is possible; syn, Nonadjustable Articulator.
b. Class II articulator: An instrument that permits horizontal as well as vertical motion but does not orient the motion to the temporomandibular joints; syn, Mean Value Articulator.
c. Class III articulator: An instrument that simulates condylar pathways by using averages or mechanical equivalents for all or part of the motion; these instruments allow for orientation of the casts relative to the joints and may be arcon or nonarcon instruments; syn, Semiadjustable Articulator.
d. Class IV articulator: An instrument that will accept 3D dynamic registrations; these instruments allow for orientation of the casts to the temporomandibular joints and simulation of mandibular movements; syn, Fully Adjustable Articulator **(GPT-9, 2017).**

Figure (1.14): Examples of articulators **(Basker, Davenport and Thomason, 2011).**

Face-bow: Is an essential accessory of semi-adjustable articulators for transferring the maxillary cast. Through facebow, maxillary and mandibular casts are mounted in relation in close proximity to the condylar hinge axis and to the temporomandibular joints producig more accurate occlusal contacts in centric and eccentric positions **(Abdeen, Shaker and Elsaadany, 2022).**

Face-bow is an instrument used to record the spatial relationship of the maxillary arch to some anatomic reference point or points and then transfer this

relationship to an articulator; it orients the dental cast in the same relationship to the opening axis of the articulator **(Murakami *et al.*, 2019).**

1.9 Arrangement of artificial teeth in balanced occlusion

Following the selection of teeth and determining the type of occlusion, the artificial teeth are arranged. Arrangement of teeth is dictated by the setting principles of individual teeth, anatomical landmarks and dentogenic concept. The ridge relation and the need to arrange the teeth in balanced occlusion also influence the procedure. The teeth should occupy the potential denture space or neutral zone.

Maxillary teeth are positioned labial to the ridge and mandibular teeth on the crest of ridge due to the resorptive pattern of the ridge. The lingual cusp of the maxillary posterior teeth should be centred over the mandibular ridge and mandibular anterior teeth should not be set too far from the centre of the ridge to ensure denture stability **(Rangarajan and Padmanabhan, 2017).**

The arrangement of teeth must be physiologically and esthetically acceptable. Physiologically, they must be compatible with the lips, tongue, and cheeks, whether the mandible is in a relaxed position or in a motion. The teeth function in harmony with the surrounding environment in masticating, swallowing, speaking, yawning and all parafunctional mandibular movements.

When the teeth are arranged to meet physiologic requirements, their positions will contribute to preserving the supporting tissues and they will appear natural in most situations **(George, 2006).**

Each tooth is attached/luted/sealed to the occlusal rim based on the following principles:

1.9.1 Maxillary central incisor

The maxillary central incisors are the critical teeth to set. They are the most visible, establish the midline, and provide the esthetic support of the patient's lip **(Zarb *et al.*, 2013).**

1. Frontal view: Its long axis inclines slightly towards the vertical axis. The incisal edge contacts the occlusal plane (Figure 1.15 A and B).

2. Side view: The position of the central incisor when viewed lingually is not straight but follows the arch form.

The maxillary teeth slopes labially about 15° when viewed from the side. The 15° angulation is more pronounced in the incisal half of the central incisor and the cervical margin should be within the occlusal rim **(Rangarajan and Padmanabhan, 2017).**

1.9.2 Maxillary lateral incisor

1. Frontal view: The long axis of the tooth is tilted towards the midline. The incisal edge is 2 mm above the level of the occlusal plane and the edge is tilted towards the midline (Figure 1.15 A and B).

2. Side view: The long axis of the tooth is sloping labially. The inclination of the slope is greater than that of the central incisor **(Nallaswamy, 2017).**

1.9.3 Maxillary canine

The maxillary canine teeth are the corner teeth of the mouth, and their location is very important.

1. Frontal view: The long axes of the canines must be parallel to the vertical axis of the face, and cervical area should be placed more labially than the incisal edge. Incisal point touching the occlusal plane and should be in the same level with the first incisors or a little above (Figure 1.15 A and B).

2. Side view: Vertical **(Ö zkan, 2018).**

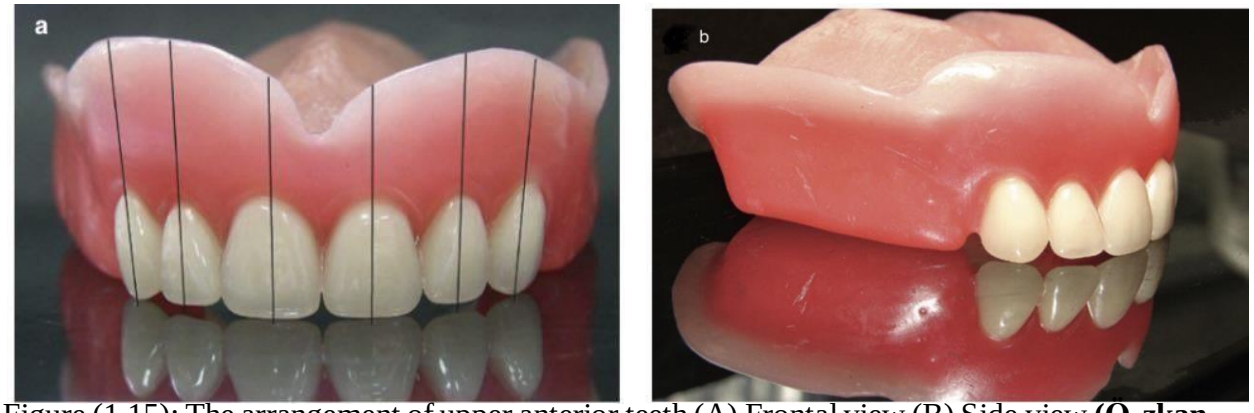

Figure (1.15): The arrangement of upper anterior teeth (A) Frontal view (B) Side view **(O zkan, 2018).**

1.9.4 Maxillary first premolar

3. Frontal view and side view: long axis parallel to vertical axis (Figure 1.16).
4. The buccal cusp touches the occlusal plane.
5. The palatal cusp is positioned about 0.5 mm above the occlusal plane **(Nallaswamy, 2017).**

1.9.5 Maxillary second premolar

1. Frontal view and side view: Long axis parallel to vertical axis (Figure 1.16).
2. Palatal cusp and buccal cusp: Both touching the lower occlusal plane **(Soratur, 2006).**

1.9.6 Maxillary first molar

Frontal view: The long axis slopes buccally.

1. Side view: long axis slopes distally (Figure 1.16).
2. Only the mesiopalatal cusp contacts the occlusal plane. Both buccal cusps slightly higher than lingual cusps. This arrangement gives rise to the lateral curves **(Soratur, 2006; Rao, 2015).**

1.9.7 Maxillary second molar

1. Frontal view: Long axis slopes buccally little more than first molar.
2. Side view: Long axis slope distally little more than first molar (Figure 1.16).
3. All four cusps do not touch the lower occlusal rim (i.e. glass slab) but the mesiolingual cusp is the nearest to the occlusal plane. In case of first and second molar-distal cusps being higher than the mesial cusp, simulate the curve of Spee (antero-posterior curve) the buccal cusps being higher than the lingual cuspssimulate the curve of Monson (lateral curve) **(Soratur, 2006).**

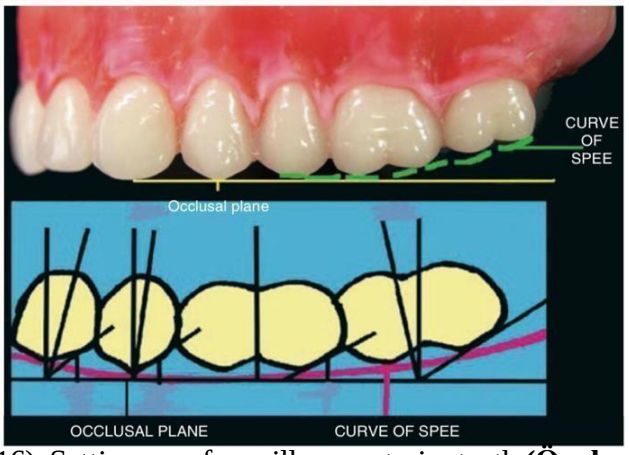

Figure (1.16): Setting-up of maxillary posterior teeth **(Ö zkan, 2018).**

1.9.8 Mandibular central incisor

1. Frontal view: Its long axis also inclines slightly towards the vertical axis (Figure 1.17).
2. Side view: It slopes labially.
3. The incisal edges of these teeth: Is about 2 mm above the occlusal plane.

4. The inclination is more pronounced in the incisal half of central incisor and cervical region within the occlusal rim. From incisal view, it follows the arch form **(Rangarajan and Padmanabhan, 2017).**

1.9.9 Mandibular lateral incisor

1. Frontal view: Same as central incisor (Figure 1.17).
2. Side view: Same as central incisor.
3. Incisal edge: Same as central incisor. But not as steep as the central incisor **(Nallaswamy, Ramalingam and Bhat, 2003; Soratur, 2006).**

1.9.10 Mandibular canine

1. Frontal view: Slight distal inclination at the neck (Figure 1.17).
2. Side view: Slight lingual tilt at the incisal edge.

3. Cusp little more than 2 mm above the horizontal plane, i.e. little above central and laterals **(Soratur, 2006).**

Figure (1.17): Setting of mandibular anterior teeth **(Ö zkan, 2018).**

1.9.11 Mandibular first premolar

1. Frontal view: The long axis of the tooth slopes slightly lingually when viewed from the front.
2. Side view: The long axis of the tooth is parallel to the vertical axis when viewed from the side (Figure 1.18).
3. The lingual cusp is below the occlusal plane and the buccal cusp should be 2 mm above the occlusal plane **(Rao, 2015).**

1.9.12 Mandibular second premolar

1. Frontal view: The long axis of the tooth slopes slightly lingually.
2. Side view: The long axis of the tooth is parallel to the vertical axis (Figure 1.18).
3. Both the cusps are 2 mm above the level of the occlusal plane **(George, 2006).**

1.9.13 Mandibular first molar

"Key of occlusion" Because this tooth plays a major role during balanced occlusion if set properly. This tooth occludes with the distal slopes of cusps of maxillary second premolar and mesial $2/3^{rd}$ of maxillary first molar.

1. Frontal view: Long axis slopes lingually.
2. Side view: Long axis slopes mesially (Figure 1.18).
3. All the cusps are at a higher level than the occlusal plane, buccal and distal cusps higher than the mesial and lingual cusps. Proper occlusion and position of this toothin relation to opposing tooth is very important **(Soratur, 2006).**

1.9.14 Mandibular second molar

1. Frontal view: Long axis is parallel to the vertical plane and follows the arch form.

2. The lingual and mesial inclination of the long axis of the teeth is more pronounced than in the case of the first molar (Figure 1.18).

All the cusps are at a higher level above the horizontal plane than those of the first molar, the distal and buccal cusps more so than the mesial and lingual **(George, 2006).**

Figure (1.18): Completed teeth arrangement in balanced occlusion (lateral view) **(Rangarajan and Padmanabhan, 2017).**

1.10 Recognition and correction of occlusal disharmony

It must be assumed that there are occlusal faults in all complete dentures until proved otherwise. Before insertion, occlusal harmony is evaluated in the lab by remounting in an articulator. All major occlusal errors are usually corrected in the lab itself. Remaining errors are corrected chair side by selective occlusal grinding. If the jaw relation is accurate, errors in occlusion are very little **(Nallaswamy, 2017; Rahn, Ivanhoe and Plummer, 2009).**

Selective Grinding: is defined as the intentional alteration of the occlusal surfaces of teeth to change their form. Selective grinding for the correction of identified occlusal interferences in the centric relation should be done first, followed by the correction of identified occlusal interferences in the eccentric relation **(Rao, 2015).**

Occlusal disharmony can be identified by:

i. Using Inter-occlusal Check Records: When the patient reports after 24 hours, an interocclusal check record is obtained. Inter-occlusal record material like ZnOE is placed on the teeth and the patient is asked to bite. High points are detected by

thepresence of perforations in the inter-occlusal records. The high points are reduced carefully using a bur and the occlusion is reverified.

ii. Using Articulating Paper: High points (premature, deflective contacts) can also be detected using an articulating paper. The articulating paper is placed between the teeth and the patient is asked to bite on it. The paper is dragged away slowly. Thereshould be even resistance to the movement of the articulating paper. If the paper slides freely, then, it means there is no contact. If the paper does not slide away at any one particularpoint, it indicates the presence of a high point. The articulating paper itself marks the high points. The high points are reduced till the marking colour fades away and occlusion is rechecked **(Nallaswamy, 2017).**

However correction of occlusal errors directly in the patient's mouth is not accepted, due to mobility of dentures on the soft tissue which obscure the errors and articulating paper will not mark efficiently, unwillingness of patients to cooperate, resulting in incorrect representation of occlusal relationships in maximum intercuspation and excursive mandibular tooth guided movements **(Patel, Ponnanna and Tripathi, 2013).**

1.10.1 Clinical occlusal errors and adjustment suggested

There are types of occlusal errors:

a. Centric occlusion errors: contacts are marked with thin articulating paper. Sufficient anteroposterior and buccolingual stabilizing tooth contacts must be provided. A pair of antagonist teeth can be too long preventing uniform contact of the other teeth. Correction of this error is achieved by deepening the fossae by grinding without reducing the cusps so as to allow the teeth to telescope into each other**(Prasad, Prakash and Jason, 2012).**

b. Working side occlusal errors: The central fossae are not deepened, but the maxillary buccal cusps and the mandibular lingual cusps are reduced. This is called B.U.L.L. rule **(Patel, Ponnanna and Tripathi, 2013).**

c. Non- Working side occlusal errors: Grinding over the mandibular buccal cusp **(Patel, Ponnanna and Tripathi, 2013).**

d. Protrusive Contacts: (1) If the anterior teeth have heavy contact with no contact on the posterior teeth. Correction: Grind the labial surface of the lower anterior andthe palatal surface of the upper anterior. (2) If heavy posterior contact exists with noanterior contact. Correction: Reduce the distal inclines of the maxillary cusps and the mesial inclines of the mandibular cusps **(Patel, Ponnanna and Tripathi, 2013).**

e. Errors in vertical dimension: May be detected by measuring freeway space indirectly (resting vertical dimension minus occlusal vertical dimension), by phonetic tests, such as ability to make bilabial or sibilant sounds, by general appearance **(Grant, Heath and McCord, 1994).**

i. Insufficient freeway space

If insufficient freeway space exists, then treatment options depend on how much reduction in vertical dimension is required. If less than 1.5 mm space is required, this may be achieved by grinding the central fossae and marginal ridges.

If more than 1.5 mm space is required and the level of one occlusal plane is acceptable, record a face-bow transfer, remove the opposing teeth by grinding and re-register in RCP prior to re-setting.

When both upper and lower planes are inappropriate, completely re-making the dentures is a sensible alternative **(Grant, Heath and McCord, 1994).**

ii. Excessive freeway space

If excessive freeway space exists, it may be corrected by adding the appropriate thickness of wax to the occlusal surfaces of the posterior teeth of the lower denture, adjusting the wax to produce an even occlusion at the desired occlusal face height and then recording the jaw relationship in centric relation **(Hassaballa, 2010).**

If all the above factors are satisfactory, initial insertion is complete. The patient is called after 24 hours to check for any soft tissue reaction. He is then called after a week for review. Finally periodic review is conducted once in every 3 to 6 months to check for soft and hard tissue changes, etc. **(Nallaswamy, 2017).**

CONCLUSION

2.1 Conclusion

In our review we conclude the following:

1. To achieve a successful conventional complete dentures fabrication, occlusionneeds to be carefully considered as it plays a role in providing uniform distribution of masticatory forces, better retention and stabilization of denture bases.
2. Many occlusal schemes have been proposed over the years. Most schemes when correctly used gives satisfactory results. The result is satisfactory, if the patient gets better function, esthetics and comfort without any adverse changes in denture foundation.
3. Bilateral balanced occlusion is considered as an ideal occlusion for complete dentures. However, B.B.O. may be difficult to achieve clinically, as well as time consuming to master, therefore, a less complicated occlusal scheme fulfilling clinical requirements become necessary.

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