

# Comparative analysis of establishing occlusion in fixed/removable partial denture, complete denture and implant

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## ABSTRACT

Occlusion as a subject, particularly as it relates to joint function, needs proper attention. Occlusion and its considerations vary in different types of prosthesis like fixed partial denture, removable partial denture, complete denture and implant. For each of the above types, the journey towards achieving occlusion varies at each step from diagnostic stage to interocclusal records to material and occlusal morphology of the teeth. The above distinctions are not very clear and often confusing. This article is a review of all the factors considered for establishing occlusion in different types of prosthesis and a comparison at each step to emphasize their clinical significance.

**KEY WORDS:** Complete Denture, fixed partial denture, implant, occlusion, removable partial denture

## INTRODUCTION

A description of occlusion is usually centered on alignment of teeth, occlusal contacts, overbite and overjet; arrangement and relationship of teeth within and between arches, and the relationship of the teeth with osseous structures. Conformity to certain standard values for these criteria is commonly used to determine whether an occlusion is normal and the descriptions of normal occlusion become very complex and somewhat controversial from one reference to another.

"Normal" implies a situation commonly found in the absence of disease, and normal values in biological system are given within a physiologic adaptive range. Normal occlusion, therefore, should imply more than a range of acceptable values: it should also indicate physiologic adaptability and the absence of recognizable pathologic manifestations. Such a concept of normal occlusal emphasizes on the functional aspect of occlusion and capability of the masticatory system to adapt to or compensate for some deviations within the range of tolerance of the system.

Occlusal interferences may or may not lead to neuromuscular or other functional disturbances within the masticatory system since the presence of such disturbances may depend on how a stomatognathic system adapts or reacts to his occlusal interferences.<sup>[1]</sup>

Hobo, in 1978, described ideal occlusal as an occlusion compatible with the stomatognathic system, providing efficient mastication and good esthetics without creating physiologic abnormalities.<sup>[2]</sup>

Guichet (1970) described standards for ideal occlusion as the following:<sup>[3]</sup>

- 1) Incorporate, in the occlusion, those factors which have to do with the reduction of vertical forces
- 2) Provide for maximum intercuspation of teeth with the condyles in centric relation
- 3) Provide for horizontal movement of the mandible from centric-related intercuspation position until those teeth are most capable of bearing the horizontal load come into function

Although such a concept of ideal occlusion enables the clinician to help patients with a low tolerance level to

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occlusal imperfections or advanced loss of periodontal support for the teeth, it does not mean that such an ideal should necessarily be imposed upon all patients with a functionally normal occlusion and healthy periodontium.

**Accepted Ideal Occlusion Schemes for designing prosthesis:<sup>[2]</sup>**

- Balanced occlusion
- Mutually protected occlusion
- Group function occlusion
- Occlusion for osseointegrated implants
- Other occlusal concepts
  - Non balanced
  - Panky- Mann Schuyler philosophy

This paper attempts to give an outline to select an occlusion scheme for each type of clinical case.

Comparison of occlusion in different types of prosthesis like fixed, removable partial denture(F/RPD); complete denture (CD) and implant will be discussed under following headings:

- During establishing or achieving the occlusion in FPD, RPD, CD and IMPLANTS
- After occlusion has been established in FPD , RPD, CD and IMPLANTS

**Comparison while Establishing/Achieving Occlusion in FPD, RPD, CD and IMPLANTS**

The major difference to be considered before designing the occlusion for each type of prosthesis is their supporting area.

In FPD, stresses are first transferred on to the abutments and then to bones around them. [Figure 1]

In RPD, stresses are transferred according to the type of prosthesis - tooth supported or tooth-tissue supported. [Figure 2]

In CD, all the teeth function as a single unit so all stresses are transferred to the underlying mucosa and bone. [Figure 3] Implant supported prosthesis will have features like any of the above types of prosthesis. They only differ in that the stresses are directly transferred to the bone through osseointegration. [Figure 4]

**A. Comparison at Diagnostic Stage<sup>[4-7]</sup>**

Occlusal analysis is done at diagnostic stage both in the mouth and by the use of articulated study casts. In both, FPD and RPD, the following factors are assessed at diagnostic stage:

- condition of abutment
- type of occlusal scheme existing
- presence of pathologic occlusion if any

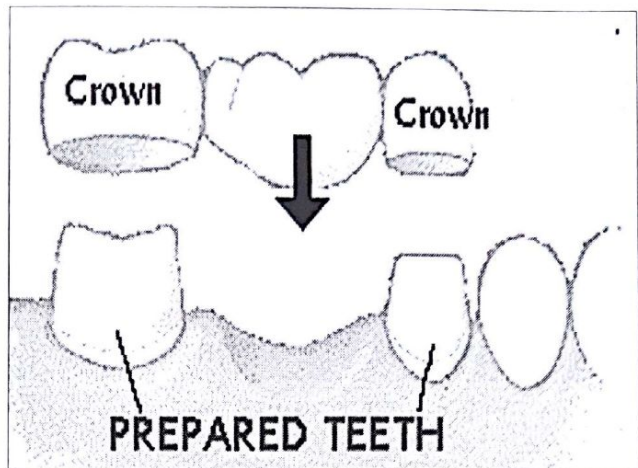


Figure 1: Support of Fixed Partial Denture from Abutment

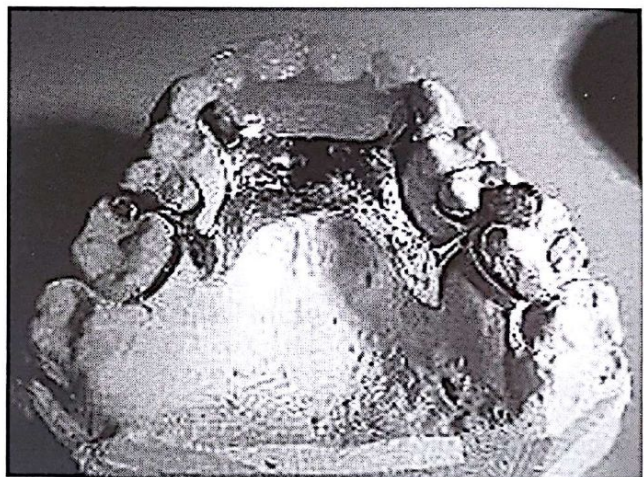


Figure 2: Support of Removable Partial Denture - Tooth- tissue/ Tooth Supported

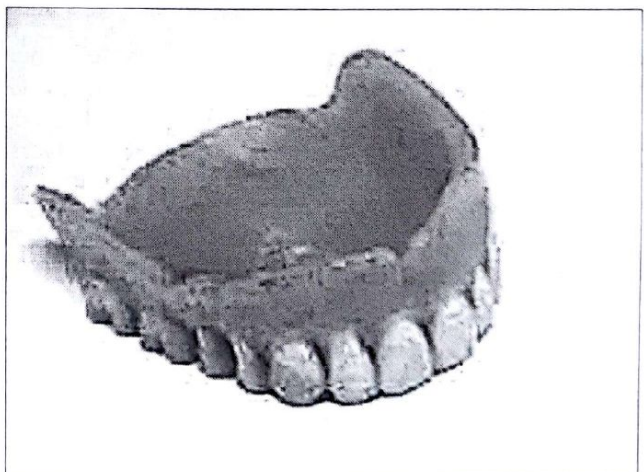


Figure 3: Support of Complete Denture - Mucosa and Underlying Bone

- pathologic migration if any
- para functional habits- wear pattern



Figure 4: Stresses Directly Transferred to Bone through Osseointegration

- occlusal discrepancies or pre-maturities
- extent of Edentulous span
- occlusal plane analysis

In CD prosthesis, following factors are assessed:

- ridge relation
- inter-ridge distance
- If old dentures are present, then check for-
- vertical relation at occlusion and rest, centric relation (any slide in centric)
- ridge condition
- neuromuscular control

In implant supported prosthesis, we need to analyze what type of prosthesis we are planning for, that is:

- Single tooth
- Long span- full implant supported, implant and natural teeth supported
- Distal extension - full implant supported, implant and natural teeth supported
- Edentulous – hybrid prosthesis, fixed metal ceramic and implant supported overdenture

In addition to the factors mentioned above, for other types of prosthesis, we need to assess the quality and volume of the bone that will help decide the type of prosthesis and hence the type of occlusion to be given.

### B. Comparison at Stage of Recording Jaw Relations<sup>4-7</sup>

Simple restorations in the form of F/RPD (tooth supported) may not require any type of face-bow record. They can be constructed on simple type of articulators. However, multiple restorations in a full mouth case should be done with Kinematic face bow on semi or fully adjustable articulators.

In CD prosthesis, (for balanced occlusion), arbitrary face bow will be sufficient with semi-adjustable articulator.

In FPD and RPD, vertical relation is either kept same as existing or sometimes restored. But in CD prosthesis it is always established in accordance to esthetics, phonetics and functions.

In fixed partial denture and removable partial denture, maximum intercuspation or centric relation is recorded along with lateral records. But in CD prosthesis, centric relation is recorded to give maximum intercuspation in same. Lateral records are not necessary.

### C. Influence of Determinants of Occlusion in Each Type of Prosthesis<sup>4-7</sup>

Following are the determinants of occlusion in fixed partial denture [Table 1]:

#### 1) Posterior determinants

- Inclination of articular eminence
- Medial wall of glenoid fossa
- Intercondylar distance

#### 2) Anterior determinants

- Horizontal overlap of anterior teeth
- Vertical overlap of anterior teeth

#### 3) Other – Occlusal plane, Curve of Spee

#### • Factors Determining Complete Denture Occlusion:

- Condylar guidance – determined by the patient
- Incisal guidance –kept as flat as esthetics and phonetics allow
- Orientation of occlusal plane –set according to

Table 1: Influence of determinants of occlusion in each type of prosthesis

	Variation	Impact on restoration (posterior cusp)
Inclination of articular eminence	Steeper	May be Taller
Medial wall of glenoid fo fossa	Flatter	Must be Shorter
	More Lat. Translation	Must be Shorter
Intercondylar distance	Less Lat. Translation	May be Taller
	Greater	Small angle-latero and medio movement
Horizontal overlap	Lesser	Large angle-latero and medio movement
	Increased	Must be Shorter
Vertical overlap	Decreased	May be Taller
	Increased	May be Taller
Occlusal plane	Decreased	Must be Shorter
	More parallel	Must be Shorter
Curve of Spee	Less parallel	May be longer
	More convex	Must be Shorter
	Less convex	May be longer

esthetics and ridge condition

Inclination of cusp - Swenson's formula can be used to determine it<sup>[8]</sup>

Prominence of compensatory curve - mainly determined by condylar guidance and can alter the effective cuspal inclination

- Removable partial denture is either affected like FPD or CD (depending upon whether tooth supported or tooth tissue supported)

**D. Establishment of Occlusion Pattern and Type of Teeth Used**

• In FPD, occlusal scheme can be classified according to location of the occlusal contact made by the functional cusp on the opposing tooth in centric relation. These schemes are of two types:

- i) cusp- fossa (as in mutually protected occlusion) [Figure 5]
- ii) cusp- marginal ridge (as in group function occlusion) [Figure 6]

• In RPD, the numbers and positions of the remaining natural teeth in both the arches in which prosthesis is being fabricated and the opposing arch determine the necessary occlusal scheme. Following are the rules followed [Table 2]:<sup>[9]</sup>

• The basic occlusal schemes used in CD prosthodontics are<sup>[10]</sup>

1. Anatomic balanced occlusion
2. Semianatomic balanced occlusion
3. Lingualized occlusion (balanced or non-balanced)
4. Non-anatomic balanced occlusion or Monoplane occlusion
5. Neurocentric occlusion

Gregory Parr and Gerald Loft had given an occlusal spectrum to select the specific scheme from the above given options for a definite case.

**Variation in use of artificial tooth material – for FPD, RPD and CD<sup>[9]</sup>**

Metal, acrylic resin or ceramic or metal ceramic (e.g. ceramogold e.t.c)

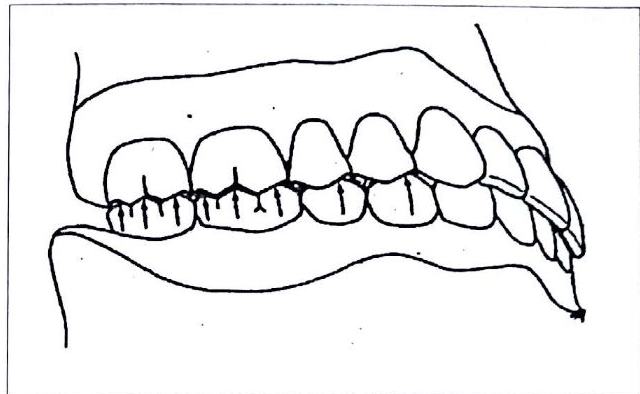


Figure 5: Cusp- fossa Occlusion

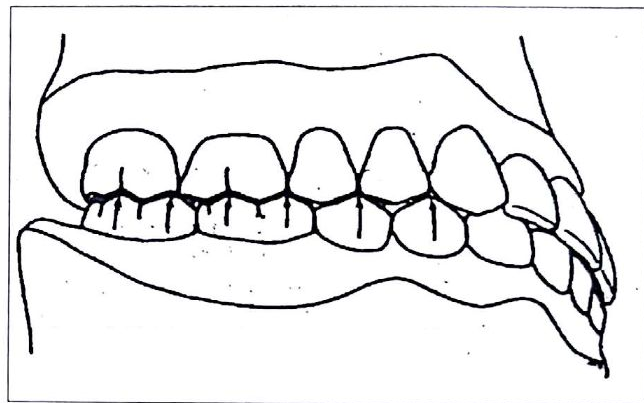


Figure 6: Cusp-marginal Ridge Occlusion

In combination fixed removable restorations, the materials to be used for restoring the occluding surfaces and their potential for wear during functional and parafunctional contacts must be critically evaluated; it could otherwise cause loss of vertical dimension of occlusion, loss of stability and centric occlusion and the development of occlusal interferences [Table 3].

The following factors should be considered while selecting the restorative material for occlusal surfaces:

- Number of teeth contributing to the occlusal support
- Material against which the restoration is to occlude
- Type of occlusal scheme

**Table 2: Rules for Establishment of occlusion scheme in RPD**

Kennedy's class	Rules
Class III	Occlusal morphology is matched with opposing teeth and existing occlusal scheme is followed Group function given if canine is missing
Class II	Balanced articulation if opposing complete denture Same as above with following exceptions: Group function is avoided if premolars absent Canine protected is preferred to reduce lateral forces
Class I	Except when opposing complete denture, balanced articulation is avoided Same as above with following exceptions:
Class IV	Balanced articulation is recommended where canine protected is not possible During excursive movements the anterior artificial teeth should either disclude or have passive occlusal contacts Balanced articulation if opposing complete denture

**Table 3: Selection of type of teeth depending upon the type of prosthesis and its opposing occlusal surface**

Opposing Occlusal Surfaces	Material Combination by Preferences	
	Anterior Teeth	Posterior Teeth
Maxillary RPD /mandibular RPD	Acrylic resin/ Acrylic resin Porcelain/porcelain	Type III gold/ Type III gold Acrylic resin/ Acrylic resin
Maxillary RPD /mandibular FPD	Acrylic resin/ceramogold Porcelain/ceramogold	Type III gold/ Type III gold Type III gold/ ceramogold Resin/ ceramogold
Maxillary RPD /natural dentition	Resin/ enamel Porcelain/enamel	Type III gold/enamel Resin/ enamel
Natural dentition /mandibular RPD	Enamel/Acrylic resin Enamel/porcelain	Enamel/Type III gold Enamel/Acrylic resin
Maxillary FPD /mandibular RPD	Ceramogold/ resin Ceramogold/ Porcelain	Ceramogold/ Type III gold Ceramogold/ resin Ceramogold/ porcelain
Maxillary FPD / mandibular FPD	Ceramogold/ Ceramogold	Ceramogold/ type IIIgold Ceramogold/ Ceramogold
Maxillary FPD /mandibular natural dentition	Ceramogold/enamel	Type III gold/enamel Ceramogold/enamel
Maxillary natural dentition/ mandibular FPD	Enamel /ceramogold Porcelain/ceramogold	Enamel/Type III gold Enamel/ ceramogold
Maxillary CD / mandibular FPD	Resin/ ceramogold Porcelain/ceramogold	Type III gold /same Resin/ gold Resin/ ceramogold

**Table 4: Comparison of different types of occlusal surfaces in Implant prosthesis**

	Porcelain	Gold	Resin
Esthetics	+(favorable)	-(unfavorable)	+
Impact force	-	+	+
Static load	+/-	+/-	+/-
Chewing efficiency	+	+	-
Fracture	-	+	-
Wear	+	+	-
Interarch space	-	+	-
Accuracy	-	+	-

- Evidence of parafunctional habits

The materials selected for occlusal surface of implant supported prosthesis affects transmission of forces and maintenance of occlusal contacts [Table 4]. Occlusal material fracture is one of the most common complications for restorations on natural teeth or implants.<sup>[11]</sup>

**Differences after Establishing Occlusion in FPD, RPD, CD and IMPLANTS<sup>[4-6,11]</sup>**

**a) Stress distribution**

- FPD - stresses shall vary with the type of connectors used, that is, rigid or non-rigid connector.
- RPD - use of stress breaker and functional impression alters the amount of stress distribution. The type of major connector, reciprocal arm and indirect retainer are also determining factors for stress distribution.
- CD- all the teeth function as a single unit so all the stresses are transferred to the underlying mucosa and bone. By using selective pressure technique we can selectively distribute the stresses amongst

primary and secondary stress bearing areas.

- In implant supported prosthesis, following are the rules to reduce stress:
  - Passive casting with cement space extending to the margin of the restoration
  - Wider the occlusal table, greater the force developed by the biologic system to penetrate the bolus of food. So occlusal table is narrowed down by under contouring lingual surface of the crown
  - All lateral excursions in implant protected occlusion opposing fixed prostheses or natural teeth should disocclude the posterior components. The resultant lateral forces are thus distributed only to the anterior segments of the jaws, resulting in a decrease in overall occlusal force magnitude because of diminished muscle firing and recruitment. This is followed whether or not anterior implants are in the arch. However, if anterior implants must disocclude the posterior teeth in excursion, two or more implants are splinted together to dissipate the lateral forces. Lateral disclusion should never be on implant
  - Crown is contoured according to division of bone<sup>[11]</sup>

Division A- Mandibular implant in division A bone is placed under original central fossa of the natural tooth, which corresponds to lingual cusp in the maxilla. Hence the mandibular buccal cusp is reduced in width and height. Primary contact is with maxillary lingual cusp. [Figure 7]

Division B- Mandibular implant in division B bone requires implant body to be placed in lingual cusp

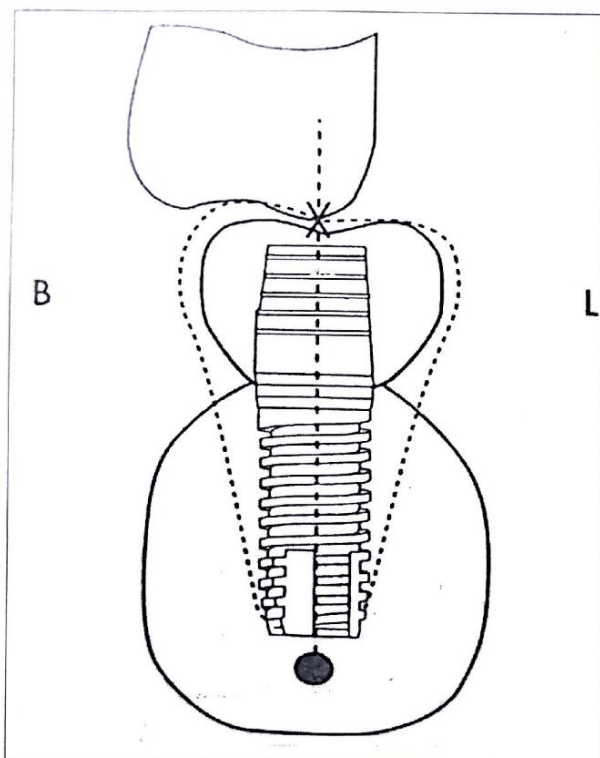


Figure 7: Mandibular Implant in Division A- Bone, B- Buccal, L- Lingual

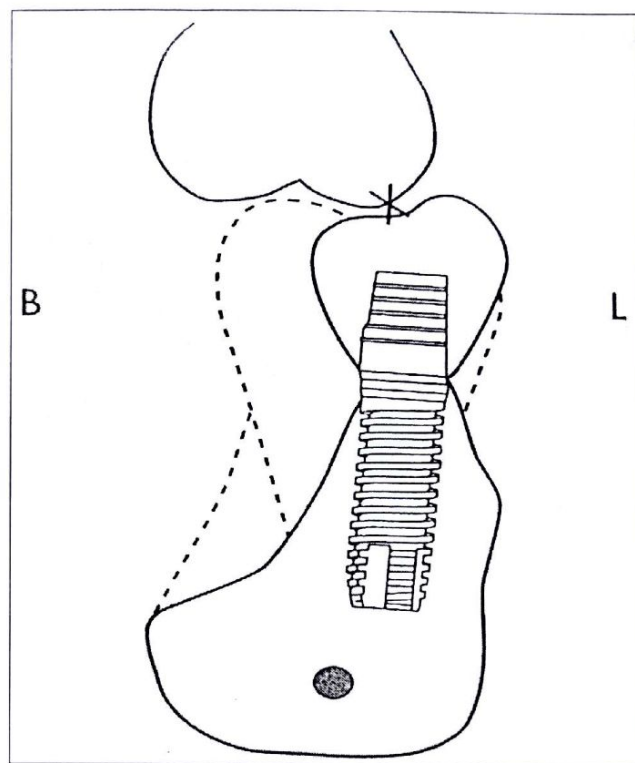


Figure 8: Mandibular Implant in Division B Bone, B- Buccal, L- Lingual

region of the original natural tooth. Lingual contour of implant crown may remain the same, but buccal cusp must be reduced in height, and occlusal table is reduced from the facial region. [Figure 8]

Progressive loading is preferred for better prognosis:

b) Follow-up of occlusion

- Follow-up regime will not vary much in any type of prosthesis.
- FPD - we check for efficiency of prosthesis and effect on temporomandibular joint; make sure clinical and radiographic examination of periodontium, selective grinding of interferences (due to wear of opposing dentition) is done.
- RPD and CD patients - in addition to all this, we need to check for any mucosal soreness. Relining is done to compensate residual ridge resorption. Special recalls are done to avoid combination syndrome in patients with maxillary complete denture and mandibular distal extension denture where patient has anterior flabby ridge in maxilla due to occlusal trauma from mandibular natural anterior teeth which come into contact due to occlusal wear of the posterior teeth.
- Implants - an integral part of implant protected

occlusion philosophy is regular evaluation and control of occlusal contacts with heavy bite force occlusal adjustment at each regularly scheduled hygiene appointment. This permits correction of minor variations occurring during long term function and also helps prevent porcelain fracture and other stress related complications on the remainder of the natural teeth.

## CONCLUSION

All of us study occlusion separately for different types of prosthesis. But the basic principles of occlusion remain same in all with the sole objective to restore the stomatognathic system to function harmoniously. This article is a review of all factors considered in the establishment of occlusion in different prosthesis and comparison of each step to emphasize their clinical significance.

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