International Journal Dental and Medical Sciences Research
Volume 3, Issue 4, July-Aug 2021 pp 676-684 www.ijdmsrjournal.com ISSN: 2582-6018

# Occlusion in Fixed Partial Denture- "Understanding the Key before Designing the Lock."

Preethy Chandran

Submitted: 01-08-2021 Revised: 11-08-2021 Accepted: 15-08-2021

**ABSTRACT:**
Replacing a missing tooth or teeth with a Fixed Partial Denture is what all patients demand or we can even say they dream of. But the question is, is their oral condition suitable for replacement of teeth using the fixed prosthesis. When finally, the dentist is convinced by the fact that the treatment plan can be arrowed towards fixed prosthesis, they should foremost keep in mind to understand what kind of occlusion he/she has, THE KEY, before fixing the prosthesis THE LOCK. Ironically most of the controversies and mysteries in the field of dentistry are surrounded around occlusion than any other. As Albert Einstein once told ''It is what we think we know that prevents us from learning more''. So a sincere attempt to study the kind of occlusion with which each patient presents to us and then planning the treatment accordingly will help give a more confident and guaranteed treatment than to waste time in "trial and errors" games with the prosthesis and "blame" games with patients.

## I. INTRODUCTION:

As in all other human systems, the tissues and functions of the masticatory system are subjected to adaptation, abuse, wear, ageing and disease. Occlusion, is, therefore, a changing condition and the responses to change vary between healthy adaptation and total disorder.[1]

The stomatognathic system is so well architected naturally that even a micron difference in the occlusal surface of a small restoration can be identified by few patients and cause them discomfort in functioning and at the same time it, has the finest capacity of maximum adaptability when forced to use a complete denture in a completely edentulous situation.

So any rehabilitation work has to be done with extreme care not to disturb the presenting stomatognathic system with its components of teeth, bone, ligament, disc, nerve and muscles only of course if it already presents with pre-existing illness. When the patients come for replacement of missing tooth/teeth one must keep in mind that their stomatognathic system is functioning well in harmony for so long asymptomatically even if they had spacing, single tooth crossbite etc, except for cases with temporomandibular dysfunction, bruxism, etc. So the operator has no right to change their occlusion in the pretext of trying to bring the occlusion to the ideal state thereby inducing iatrogenic interferences affecting the stomatognathic system's harmonious run.

What does it mean to say that "the occlusion is ideal"?

Beyron[2] has characterized few essential features of occlusion as

1.Maxium no of bilateral centric stops during closing in a maximum intercuspation regardless of any specific relationship.

2.As far as possible ,axial loading of posterior teeth for optimal force distribution within the alveolus.

3. Freedom in the retrusive range of occlusal contact movement ,because this ensures that the mandible is not being forced into border position as the teeth are meeting in centric occlusion.

4.Multidimensional freedom of occlusal contact movement, with group function during laterotrusion, and anterior tooth protrusion. This provides the most favourable force distribution for each type of functional movement.

5.Adequate vertical dimension of occlusion

DAWSON [3](1974) also has put forth his ideas for deriving an ideal occlusion

1.Stable stops on all teeth when the condyles are in the most superior posterior position.

2.An anterior guidance that is harmony with the border movements of the envelop of function.

3.Disclusion of all the posterior teeth in protrusive movements.

4. Disclusion of all posterior teeth on the balancing side.

5.Non interference of all posterior teeth on the working side with either the lateral anterior guidance or the border movements of the condyles.

Okeson has recommended permanent alteration of the occlusal condition for two reasons only . One for improving the function and esthetics considerations between the maxillary and mandibular teeth., secondly for eliminating a TMD disorder.To say in simple words ideal occlusion means just follow what Okeson[4] said 'the most

International Journal Dental and Medical Sciences Research
Volume 3, Issue 4, July-Aug 2021 pp 676-684 www.ijdmsrjournal.com ISSN: 2582-6018

favourable occlusal concept is that which is least pathogenic for the greatest number of patients over the longest time'.

Now our objective is to determine to what extent the patient's occlusion differs from ideal and how well the patient has adapted to this difference. Special attention is given to initial contact, tooth alignment, eccentric contacts, and jaw manoeuvrability[5].

Therefore, in the normal occlusion, there will be a reflex function of the neuromuscular system, producing a mandibular movement that avoids premature contacts. This guides the mandible into a position of maximal intercuspation with the condyle in a less-than-optimal position. The result will be either some hypertonicity of nearby muscles or trauma to the TMJ, but it is usually well within most people's physiologic capacity to adapt and will not cause discomfort[6].

So at the end of the treatment one must confirm that the physiological occlusion is obtained, which is beautifully said as"An occlusion which is in sufficient harmony with the anatomic and physiologicalcontrols of the mandible so that pathology will not be precipitated[7]."

DETERMINANTS OF OCCLUSION

The determinants of occlusion is divided in to two types

1.Posterior determinants
2.Anterior determinants

1.POSTERIOR DETERMINANT

The posterior determinants of mandibular movement are the temporomandibular controls and their associated structures. These associated structures are shape of the articular eminences, anatomy of the medial walls of the mandibular fossae,configuration of the mandibular condylar processes all of which cannot be altered by the dentist.

2.ANTERIOR DETERMINANTS

The anterior determinants are the vertical and horizontal overlaps of the anterior teeth and the form of the lingual concavities of the maxillary anterior teeth which can be altered by the operator. These determinants decide on the nature of the restoration or rehabilitation work to be conducted, for example the height of the cusp can be determined depending on how greater or lesser is the curve of Spee[8].

EVOLUTION OF OCCLUSION THROUGH THESE YEARS

Occlusion has always been a mystifying topic in dentistry, leaving most of us perplexed when presented with a complicated case especially with full mouth rehabilitation with loss in the vertical dimension. It all started in the 1950s with the concept of balanced occlusion then slowly evolving to the present day mutually protected occlusion, let us have a brief look on the history of evolution of occlusion and the diverse contributions by eminent researchers

- Von Spee in 1890 had described about vertical overlap ''overbite'' of the cuspids.
- In 1915, Gysi described the masticating functions of the teeth and the scheme of canine-protected occlusion .
- A Gnathologic society[9] was founded by McCollum in 1926.
- McCollum together with Stuart published their classic ''Research Report'' in 1955 and gave the Gnathological Concept. This concept illustrates development of mandibular movements, transverse hinge axis, maxillomandibular relationships, and an Arcon fully adjustable articulator. As a result of which balanced occlusion was being applied to natural dentition also.
- But later, the proportion of clinical failures let to the observation by STUART that there was unequal wear of the buccal and lingual cusps causing deflective occlusal contacts with a loss of centric-related closure, causing patients to bite their cheeks and tongue.
- In later years Stuart and Stallard observed that canines discluded all other teeth in laterotrusive (working) excursion which was similar to the observation of D'Amico, then came the concept of mutually protected occlusion.
- D'Amico[10] in 1958 studied the significance of cuspid teeth and presented the Concept of Canine Guidance (Canine disclusion) in which the maxillary canine teeth serve to guide the mandible during eccentric movements and when in functional contact with the lower canines and first premolars, determine both lateral and protrusive movements of the mandible.Thus concluding that the balanced occlusion is suited only for completely edentulous arches and not suitable but also harmful when applied to natural dentition and fixed prosthodontic rehabilitation work.
- The Point Centric concept[11] was proposed wherein the condyles should seat in a rearmost position in the mandibular fossae exactly at the time when maximum intercuspation of the teeth occurs in the retruded contact position.

- Schuyler[12] first introduced the Concept Of 'Freedom in Centric'' and supported the theory that centric relation was rather a biological area of the TMJ than a point. In this concept, ''there is a flat area in the central fossae upon which opposing cusps contact which permits a degree of freedom (0.5–1 mm) in eccentric movements uninfluenced by tooth inclines''. It relies on cusp-to-surface mechanics.
- Dawson[3] used the term 'long centric' for freedom in centric. Long centric accommodated changes in head position and postural closure. The measurable amount of long centric needed is the difference between centric-related closure and postural closure which is rarely more than 0.5 mm.
- Ash and Ramfjord also advocated the horizontal ''long centric''.
- Pullinger et al. suggested that an intercuspal position anterior to the retruded contact position in association with bilateral occlusal stability may be protective.
- According to Wiskott and Belser[11], in natural dentition, occlusal contacts are few and not ideally placed and teeth stability is independent of occlusal relationships. Thus they proposed simplified pattern of occlusal contacts that provides adequate function, esthetics and stability for restorations.
- Pankey–Mann–Schuyler (PMS) Philosophy of Oral Rehabilitation[13] was introduced. It was based on spherical theory of occlusion by Meyer and Brenner.
- The Pankey-Mann-Schuyler (PMS) philosophy aims at achieving the following principles of occlusion advocated by Schuyler:

1. Maximum number of contacts on posterior teeth in CR.
2. Posterior teeth disocclusion during protrusion.
3. Functionally harmonious anterior guidance.
4. Absence of interferences on the nonworking side during lateral excursions.
5. Group function occlusion on the working side during lateral excursions.

- Hobo[14] introduced the twin table technique in which it was summarised that anterior guidance influences the working condylar path and even changes when the lateral incisal path deviates from the optimal orbit.
- Youdelis Scheme[15]was primarily suggested for advance periodontitis where canine-guided disclusion was planned, and with the loss of canine, the occlusion shall shift to group function occlusion.
- Nyman[16] System was designed for advanced periodontitis situation and long span prosthesis. The teeth are splinted to reduce the mobility and distribute the load to all teeth.

Before going into detail of treatment planning, mastering of certain terms are essential to understand the basics of occlusion. They are the definition as given in GPT 9

| | |
|---|---|
| CENTRIC RELATION | A maxillomandibular relationship, independent of tooth contact, in whichthe condyles articulate in the anterior-superior position against the posterior slopes of the articular eminences; in this position, the mandible is restricted to a purely rotary movement; from this unstrained, physiologic,maxillomandibular relationship, the patient can make vertical, lateral or protrusive movements; it is a clinically useful, repeatable reference position |
| 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; |
| MAXIMUM INTERCUSPATION | The complete intercuspation of theopposing teeth independent of condylar position, sometimes referred to as the best fit of the teeth regardless of the condylarposition; CENTRIC OCCLUSION. During function MI is the starting and end point of chewing cycle[17]. |
| ANTERIOR GUIDANCE | 1. The influence of the contactingsurfaces of anterior teeth, limiting mandibular movements; |

International Journal Dental and Medical Sciences Research
Volume 3, Issue 4, July-Aug 2021 pp 676-684 www.ijdmsrjournal.com ISSN: 2582-6018

| | |
|---|---|
| | 2. the influence of the contacting surfaces of the guide pin andanterior guide table on articulator movements; ANTERIORGUIDE TABLE;<br>3. the fabrication of a relationship of the anterior teeth preventing posterior tooth contact in all eccentric mandibularmovements; ANTERIOR PROTECTED ARTICULATION, GROUPFUNCTION, MUTUALLY PROTECTED ARTICULATION |
| CENTRIC SLIDE | The movement of the mandiblewhile in centric relation, from the initial occlusal contact into maximal intercuspal position (GPT-4) |
| CONDYLAR GUIDANCE | Mandibular guidance generated by the condyle and articular disc traversing the contour of the articular eminence(GPT-9) |

The three types of occlusion are:

1.BILATERALLY BALANCED OCCLUSION- By von Speeand Monson.It dictates that a maximum number of teeth should contact in all excursive positions of the mandible.This is particularly useful in complete denture construction, in which contact on the nonworking side
is important to prevent tipping of the denture. As trying this out in natural dentition caused many wear faucets due to excessive friction it was not advisable to be used in natural dentition .

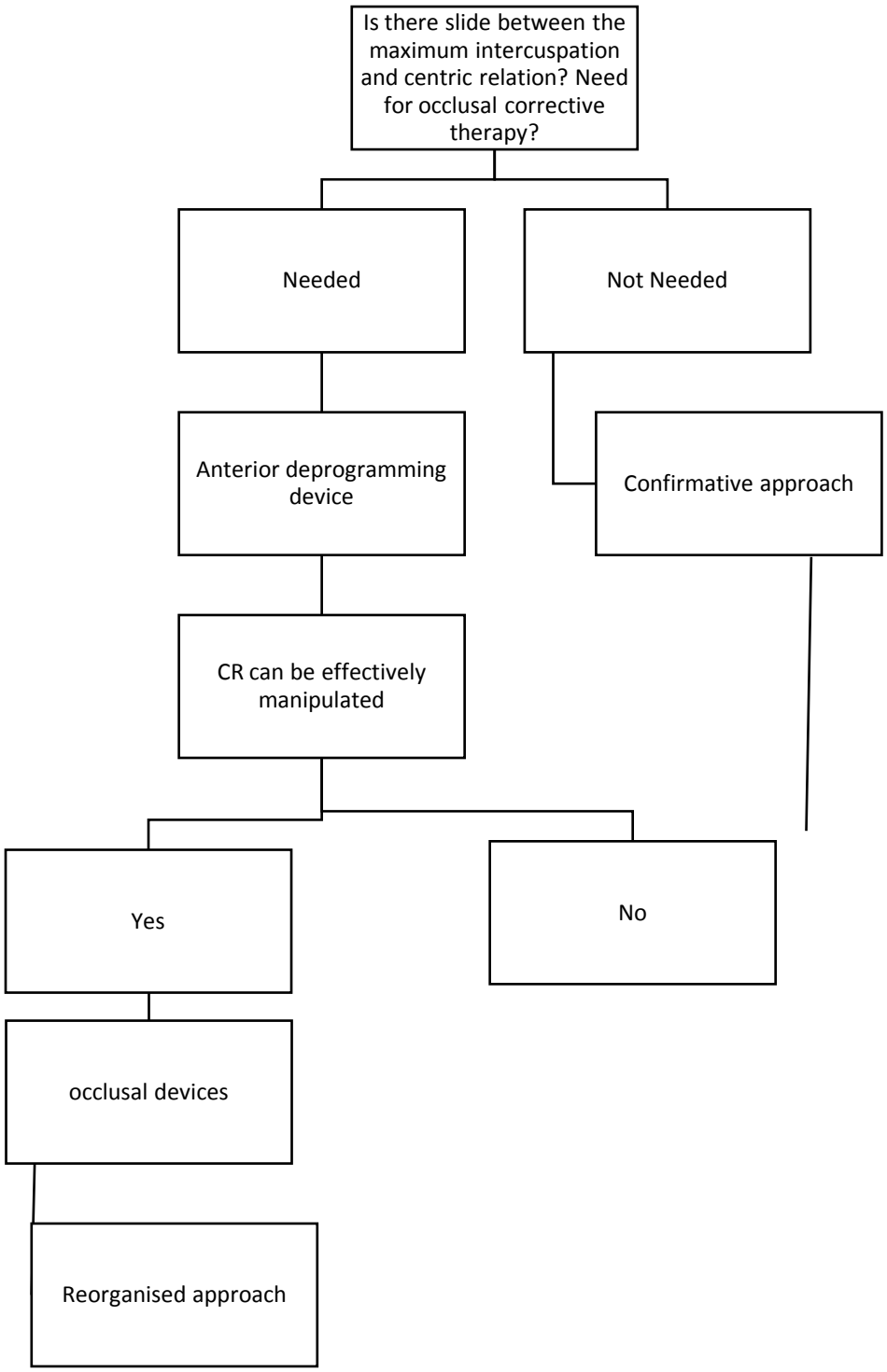
2. UNILATERAL BALANCED OCCLUSION-/GROUP FUNCTION- By Schuyler. Here all teeth on the working side should be in contactduring a lateral excursion. On the other hand, teeth on the nonworking side are contoured to be free ofany contact. The group function of the teeth on the working side distributes the occlusal load. Theabsence of contact on the nonworking side prevents those teeth from being subjected to thedestructive, obliquely directed forces found in nonworking interferences. It also saves the centricholding cusps (ie, the mandibular facial cusps and the maxillary palatal cusps) from excessive wear.

3.MUTUALLYPROTECTEDOCCLUSION/CANINE PROTECTED OCCLUSION/ORGANIC OCCLUSION- By D'Amico,Stuart,Stallard and Stuartand Lucia. As the anterior teeth protect the posterior teeth in all mandibular excursions and the posteriorteeth protectthe anterior teeth at the intercuspal position, this type of occlusion came to be knownas a mutually protected occlusion.Mutually protected occlusal scheme has become the champion in full mouth rehabilitation programmes mostly, next comes group function scheme.

TREATMENT PLANNING

1. Diagnosis and treatment planning
2. Proper eliciting of history ,being a little more attentive to whatexactly are the patients expectation.( so in turn the operator can explain earlier even before treatment starts whether patient's expectation can be met or not)
3. Intra oral and Extra oral examination, including TMJ and palpation of muscles of mastication. The TMJs should be examined for sounds, tenderness to palpation andrange of motion. Three muscle groups are examined: the temporalis and masseter muscles are tested for tenderness to palpation, whereas thelateral pterygoid muscles are tested by the resisted movement test[18.]Diagnostic casts and radiographs and Photographs are taken.
4. Studying the data received and start planning on the type of rehabilitation work.
5. Face bow transfer and articulation.
6. Recording of Centric relation.DawsonBimanual palpation is considered the most reliabletechniques.[4]

International Journal Dental and Medical Sciences Research
Volume 3, Issue 4, July-Aug 2021 pp 676-684 www.ijdmsrjournal.com ISSN: 2582-6018




These occlusal devices act like a blue print for the planned fixed prosthesis especially for patients requiring extensive rehabilitation work. The patient's response to these devices helps the practitioner to envision the prognosis of the fixed prosthesis.

| | CONFORMATIVE APPROACH | REORGANISED APPROACH |
|---|---|---|
| | Restorations done without altering the existing jaw relation[19].<br>It gives restorations in the pre existing occlusion even if the CR is not coinciding with MIP, in asymptomatic patients | Restorations done altering the existing jaw relation. |
| | 1.It is not necessary to alter the vertical dimension.<br>2.Sufficient teeth are present to guide to normal MIP in an asymptomatic patient.<br>3.Elimination of the non-working contacts.<br>,elimination of non-working side interferencesand removal of a deflective contact on tooth tobe restored. | An increase in vertical height is wanted or indicated in cases like[20].<br>1.When a tooth or teeth have severe attritional wear,significantly out of<br>position (ie overerupted, tilted or rotated) casusing unacceptable function, unsuitable esthetics, untolerable sensitivity or pain<br>2. There is a history of recurrent occlusally related failure or fracture of existing restorations.<br>3. Recurrence of a temporomandibular disorderthat has relapsed after a period of successful splint therapy |
| | It is safe,as no change in occlusal scheme is done,thus reducing the probability of problems with teeth and its surrounding structure after rehabilitation. | |
| | Function generated pathway technique is followed to retain what harmonious occlusion the patient had presented with. | |
| | This sequence is described by the<br>E.D.E.C. principle[21]:<br>E – Examine the pre-operative occlusion;<br>D – Design the restoration;<br>E – Execute that design;<br>C – Check the restoration adds to,<br>but does not change, the occlusion between the other teeth (i.e. the confirmative approach) | For a reorganised treatment plan the following steps are followed[21].<br>The EDEC principle in the<br>re-organised approach<br>E = Examine the characteristics of<br>the existing occlusion, including jaw relationship<br>D = Design and plan the new occlusion<br>E = Execute the new occlusal<br>Prescription prior to definitive restorations<br>C = Check that you are conforming<br>to this new occlusion in the definitive restorations.<br>So once the assessment is done the suitable occlusal scheme is chosen. This depends on that particular case and the experience the |

| | | |
|---|---|---|
| | | dentist has gained in following certain scheme. For example these steps are to be followed as described by Robert Wassell[22].<br>1.First provide posterior stability,so that deflective contacts and interference are removed.<br>2.Providing stable Intercuspal position.<br>3.Establish anterior guidance on provisional restoration.<br>4.Transfer the same anterior guidance in to the definitive restoration.<br>5.Finish with definitive posterior restoration. |

OCCLUSION IN IMPLANT SUPPORTED PROSTHESIS

There is a vast difference between restorations done supported by teeth to the one on an implant. How the stress acts on these restorations and how these restorations behave in response to these stress cannot be compared with that of the natural dentition as there is no cushioning effect of the periodontal ligaments in implant-supported/retained dentures, so to apply the same concept of occlusion as that of the natural dentition cannot be justified or rationalised fully by the practitioner.

So the concept of Implant Protected Occlusion is being followed in rehabilitation using implants. A mutually protected occlusion with anterior guidance and evenly distributed contacts with wide freedom in centric relation is advised for implant supported prosthesis[23].

## II. DISCUSSION

CHECK LIST ONCE THE TREATMENT IS DONE

- ✓ Build the occlusion around reproducible jaw position, achieving an appropriate vertical dimension and providing an appropriate occlusal scheme.
- ✓ The factor that has most clinical significance in achieving successful alleviation of pain and discomfort in the musculature is the complete seating of the TMJs into a relationship with the fossae that is comfortable, even when the joints are fully loaded. ( A classification system for occlusions that relates maximal intercuspation to the position and condition of the temporomandibular joints Peter E. Dawson,).
- ✓ In restored dentition, it is widely accepted to have cusp fossa contact. This shall establish tripoding of occlusal contacts, distributes the forces along the long axis of the teeth and aids in achieving better occlusal stability[24].
- ✓ Terry Walton[25] states that the restorations should be finished in such a way that by maintaining proper interproximal contacts facilitates better intraarch stability, and interarch tooth stability is facilitated by bilateral contacts between opposing teeth in the intercuspal position.
- ✓ The patient should complete each treatment visit with an even, bilateral, non deflective occlusal contact on the prosthesis in centric relation. This progressive program will help the patient find, through comfortable function, the optimum mandibular posture. It is a learning process for the dentist, different with each patient, and is a training process for the patient[26].
- ✓ The end treatment plan should give a stable occlusion meaning in which there is no room for supra eruption, tilting or drifting so that it does not lead to occlusal interference. Unplanned restorations always leads to occlusal disharmony. A stable posterior occlusion along with smooth uninterrupted protrusive and lateral excursions is the ideal goal to achieve in prosthodontic treatment involving occlusal changes.
- ✓ It seems that at least one or more occlusal contacts per occlusal unit is enough for the long-term service and acceptable patient-assessed oral function, which is in agreement with biological occlusion[27].
- ✓ Long term monitoring of the teeth and supporting structures should include adjustments to re-establish the described contact patterns, thus maximizing the biological,physiological and mechanical stability[28].

## III. CONCLUSION:

As Huffman and et al implied the word ideal implies something like infinity in that it can be approached but never actually reached.. One has to envision the terminal results and draft a plan

during the steps of diagnosis and treatment planning itself. In this way, the patient can be explained to what to expect and what not to, thereby gaining the patient's trust towards our treatment. Follow-up care and regular recall is a mandatory part of any treatment plan. Early detection of any minute sign of disease will lead to a timely help preventing many future disasters.

## REFERENCES:

[1]. Occlusion : Hamish Thomson 1975 John Wright and Sons Limited.
[2]. Beyron H: Characteristics of functionally optimal occlusion and principles of occlusion rehabilitation. j am dent assoc.1954;48;648-656.
[3]. Dawson.P.E.Evaluation,Diagnosis and Treatment of occlusal problems.St.Louis MO.CV Mobsy Co (1974)
[4]. Okeson JP: Management of temperomandibular disorders and occlusion 5 th edition st louis hyleermosby 2003;109-126.
[5]. Rosientiel:Contemporary fixed prosthesis fifth edition
[6]. Shillingburg. Fundamentals of fixed prosthodontics: fourth edition
[7]. G. Newell Wood: Centric relation and the treatment position in rehabilitating occlusions: A physiologic approach. Part II. The treatment position. Journal of Prosthetic Dentistry: June 1988: Vol 60:no 1.
[8]. Ash Major M : An Introduction to Functional Occlusion : W B Saunders Company 1982
[9]. Paul.H.Pokorny,Jonathan.P.Weins,Harlod Litvek:Occlusion for fixed prosthodontics;Ahistorical perspective of the gnathological influence:JPD 2008:99:299-313.
[10]. D Amico A : Functional occlusion of the natural teeth of man : Journal of Prosthetic Dentistry 1961:11:899-915.
[11]. Bhawana Tiwari, Komal Ladha, Aaruti Lalit, B. Dwarakananda Naik: Occlusal Concepts in Full Mouth Rehabilitation: An Overview J Indian Prosthodont Soc 14(4):344–351.
[12]. Clyde.H.Schyler:The function and importance of incisal guidance in oral rehabilitation:Journal of Prosthetic Dentistry : Nov- Dec:1963:vol 13 :No 6.
[13]. Pankey and Mann:Oral Rehabilitationpart II. Reconstruction Of The Upper Teeth Using :A Functionally Generated Path Technique: Journal Of Prosthetic Dentistry Jan --Feb :Vol 10: No 1
[14]. Sumiya Hobo :Twin table technique for occlusal rehabilitation:Part I Mechanism of Anterior Guidance.: Journal of Prosthetic dentistry sep :1991:Vol:66 No 3.
[15]. Dr. Abhishek Sharma, Dr. Isha Sharma, Dr. Mohit Kaushik, Dr. Atul Kumar, Dr. Hena And Chirantan Chowdhury: Various Concepts Of Occlusion In Full Mouth Rehabilitation: A Review International Journal of Applied Dental Sciences 2020; 6(3): 560-564.
[16]. Nyman S, Lindhe J. Considerations on the design of occlusion in prosthetic rehabilitation of patients with advanced periodontal disease. J Clin Periodontol 1977;4:1-5.
[17]. H.W.Anselm Wiskott,C.Belser: A rationale for simplified occlusal design in restorative dentistry: historical review clinical guidelines. .Journal of Prosthetic Dentistry.1995 feb vol 73 no 2
[18]. Stefan Davies: Occlusion in Restorative Dentistry Conformative,Re-organised or Unorganised. Dental Update- July/Aug 2004
[19]. Rita Zarina,J.L.Jaini,Rajan.S.Raj:A Systemic approach for rehabilitation of occlusion in Fixed Partial Denture : International Journal of Preventive and clinical Dental research April -June :4(2) 136-141.
[20]. Bharat Raj Shetty, Manoj Shetty, Krishna Prasad D., S. Rajalakshmi, Raghavendra Jaiman.:Philosophies In Full Mouth Rehabilitation – A Systematic Review : International Journal Dental Case Reports 2013; 3(3): 30-39
[21]. S. J. Davies,R. M. J. Gray, and S. A. Whitehead, : Good occlusal practice in advanced restorative dentistry: British Dental Journal, Volume 191, No. 8, October 27 2001
[22]. Robert Wassell,Auras Naru,Jimmy Steele,Francis Nohl :Applied Occlusion:Quintessence Pub.
[23]. Rachel A. Sheridan. Ann M. Decker,,Alexandra B. Plonka, and Hom-Lay Wang, The Role of Occlusion in Implant Therapy:A comprehensive updated review. Implant dentistry : volume 25, number 6 2016.
[24]. Chander NG: Deciphering the opinions in full mouth rehabilitation. Journal of Indian Prosthodontic Society 2020;20:225-7.
[25]. Terry Walton : Occlusion and fixed prosthodontics: chapter 17.

[26]. G.Newell Woods:Centric Relation And Treatment Position In Rehabilitating Occlusion:A Physiological Approach. Part I Developing An Optimum Mandibular Posture: Journal Of Prosthetic Dentistry: 1988: Vol 59:No 6.
[27]. J. Stipeti Et Al.: Analysis Of Occlusal Contacts, Collegium Antropologicum. 25 (2001) 1: 311–316
[28]. Iven Klineberg,Steven.E.Eckert: Functional occlusion in restorative dentistry and Prosthodontics. .Elesevier Mobsy: 2016