INDIAN JOURNAL OF DENTAL ADVANCEMENTS

Journal homepage: www.nacd.in

REVIEW

Occlusion and Occlusal Considerations in Implantology

Shantanu Jambhekar[1], Mohit Kheur[2], Mukund Kothavade[3], Ramandeep Dugal[4]

Dept. of Prosthodontics,
M A Rangoonwala College of Dental Sciences and Research Centre, Pune.

Postgraduate Student[1]
Professor & PG Guide[2]
Professor & Head[3]
Professor[4]

Article Info
Received: 7th October, 2009
Review Completed: 15th November, 2009
Accepted: 10th December, 2009
Available Online: 18th April, 2010

Abstract :

The introduction of osseointegrated implants has completely altered the prosthetic treatment of partially and fully edentulous patients. Besides other aspects that form a part of Implantology as a science, planning and delivering the optimal occlusion is an integral part of implant supported restorations.

Due to lack of the periodontal ligament, osseointegrated implants, unlike natural teeth, react biomechanically in a different fashion to occlusal force. Dental implants are more prone to occlusal overloading, which is often regarded as one of the potential causes for peri-implant bone loss and failure of the implant/implant prosthesis. The special conditions unique to implants necessitate developing an occlusion that places minimum stress on the implant, the implant- restoration interface and the restoration per se. The types and basic principles of implant occlusion have largely been derived from occlusal principles in tooth restoration. These occlusal concepts (i.e. balanced, group-function, and mutually protected occlusion) have been successfully adopted with modifications for implant-supported prostheses.

This paper discusses the role of occlusion as related to implantology and provides clinical guidelines for choice of occlusal schemes for implant retained restorations

Key words: ***IMPLANTS, OCCLUSION***

The literal definition of occlusion is 'the act of closure or state of being closed or shut off'.

Unfortunately in dentistry the term connotes a static morphologic tooth contact relationship. However the term should have in its definition the concept of a multi factorial relationship between the teeth and the other components of masticatory system.

Terminologies:

Anterior Guidance:

Anterior guidance refers to the dynamic relationship of the lower anterior teeth against the lingual contours of the maxillary anterior teeth in centric, long centric and in their protrusive, latero-protrusive, and lateral excursions. Along with centric relation and vertical dimension, anterior guidance must be regarded as the most important factor in reconstructing the stomatognathic system.

Ideal Occlusion:

Ideal occlusion is an occlusion compatible with the stomatognathic system providing efficient mastication and good esthetics without creating physiologic abnormalities.

Dawson (1974) also described five concepts important concepts important for an ideal occlusion:

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

Address for correspondence:
shantanujambhekar@gmail.com

2. An anterior guidance that is in harmony with the border movements of the envelope of function.
3. Disclusion of all the posterior teeth in protrusive movements.
4. Disclusion of all the 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.

There is no one occlusal pattern for all individuals but an appropriate pattern can be found based on the above criteria. There are three accepted and recognized ideal occlusal schemes that describe the manner in which the teeth should and should not contact in various functional and excursive positions of the mandible. These include balanced occlusion, mutually protected occlusion and group function occlusion.

Bilateral balanced occlusion:

This is useful in construction of complete dentures, in which contact on the non working side is important to prevent tipping of the denture. It was also later utilized in complete occlusal rehabilitation with an objective of sharing the stress on more number of teeth. However it was soon discovered that it was difficult to achieve and it resulted in excessive frictional wear of the teeth.

A balanced occlusion in natural dentition with normal periodontium is difficult to find. When seen, it is usually the result of advanced attrition.

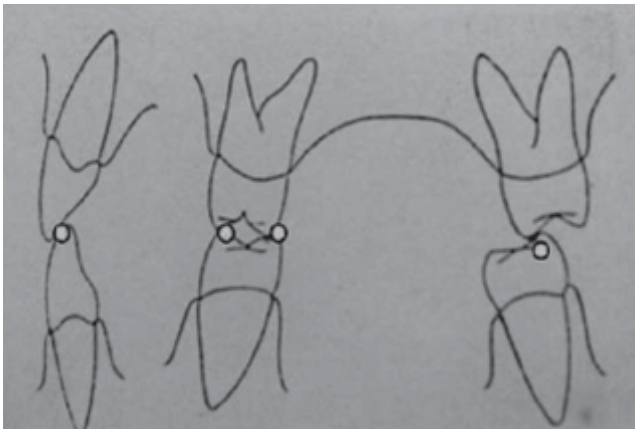

Fig.2 Balanced Occlusion: All teeth contact during centric and eccentric movements.

(Red mark shows contact points between maxillary and mandibular teeth during lateral movements.)

Group Function Occlusion:

Destructive forces associated with nonworking side contacts were first observed by Schuyler who concluded that they were traumatic to the natural dentition, causing neuromuscular disturbances, temporomandibular joint dysfunction, accelerated or increased periodontal breakdown and excessive wear. Further work by other investigators resulted in balanced occlusion being replaced with unilateral balanced occlusion, otherwise known as 'group function'.

The group function on working side distributes the occlusal load. Absence of contacts on non working side prevents those teeth from being subjected to the destructive, obliquely directed forces found on the non working side. Beyron has shown that it prevents excessive wear of the centric holding cusps thus helps in maintenance of occlusion

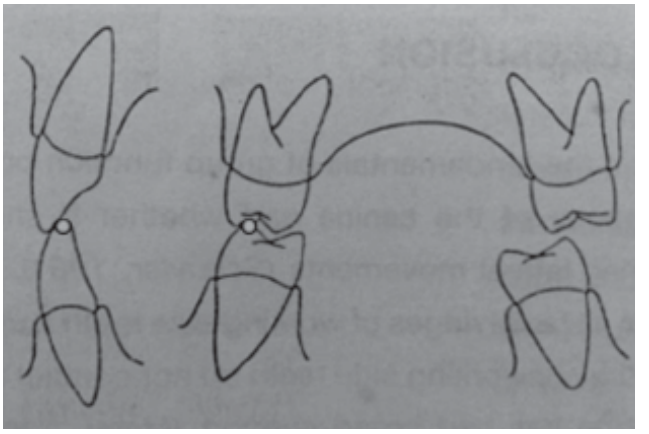

Fig3. Group Function Occlusion: Horizontal pressures during lateral movements are distributed to one half of the arch from central incisor through molar on the working side.

Mutually protected Occlusion

Mutually protected occlusion is also called as canine protected occlusion or organic occlusion. In this occlusal scheme, maximum intercuspation coincides with the optimal condylar position of the mandible (centric relation). The posterior teeth are in contact with forces being directed along their long axis. During lateral or protrusive excursions, the six anterior maxillary teeth, together with the six anterior

mandibular teeth guide the mandible so that no posterior occlusal contacts occur. The desired effect of this is the absence of frictional wear.

We can thus see how this occlusion is mutually protective—the posterior teeth protect the anterior teeth at centric relation, while incisors protect the canine and posteriors in protrusion while canines protect the incisors and posterior teeth during lateral excursive movements.

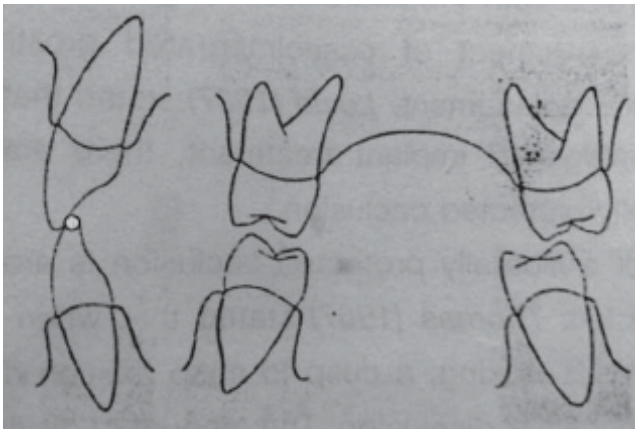

Fig.4 Mutually Protected Occlusion

Occlusal considerations for Implantology

Introduction of osseointegrated implants in early 1980's altered the way in which partially and fully edentulous patients are treated prosthetically. Dentures are more stable with attachments on implants and implants can act along with natural dentition as abutments or can stand alone to support fixed prostheses.

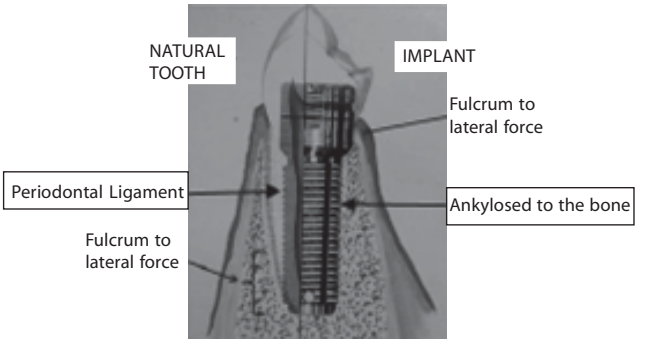

Fig.5 Natural tooth V/S implant

Because of the special conditions unique to implants it is important to develop an occlusion that places minimum stress on both the bone implant interface and prosthesis. The types and basic principles of implant occlusion have largely been

The differences between the natural teeth and the implants can be summarized as follows:

	Natural Tooth	Implant
Connection	Periodontal ligament (PDL)	Osseo integration , functional ankylosis
Proprioception	Periodontal mechanoreceptors	Osseoperception
Tactile sensitivity	High	Low
Axial mobility	25–100 mm	3–5 mm
Movement phases	Two phases Primary: non-linear and complex Secondary: linear and elastic	One phaseLinear and elastic
Movement patterns	Primary: immediate movement Secondary: gradual movement	Gradual movement
Fulcrum to lateral force	Apical third of root	Crestal bone
Load-bearing characteristics	Shock absorbing function Stress distribution	Stress concentration at crestal bone
Signs of overloading	PDL thickening, mobility, wear facets, fremitus, pain	Screw loosening or fracture, abutment or prosthesisfracture, bone loss, implant fracture

derived from occlusal principles in tooth restoration. These occlusal concepts (i.e. balanced, group-function, and mutually protected occlusion) have been successfully adopted with modifications for implant-supported prostheses. Furthermore, implant-protected occlusion has been proposed strictly for implant prostheses. This concept is designed to reduce occlusal force on implant prostheses and thus to protect implants.

Besides the principles of Dawson described earlier, other modifications from the conventional occlusal concepts that have been proposed in literature includes

- providing load sharing occlusal contacts,
- occlusal morphology guiding occlusal force to the apical direction with narrow occlusal table with flat area at the centre, decreased cuspal inclination and wider grooves and fossae,
- correction of load direction(axial loading)
- increasing of implant surface areas,
- and elimination or reduction of occlusal contacts in implants with unfavorable biomechanics.

Occlusal guidelines that need to be considered (in addition to the above guidelines) while restoring various clinical situations with implant supported prostheses are:-

Sr. No.	Edentulous classification	Type of prosthesis	Optimal Occlusal Scheme	Additional guidelines
1	Edentulous	**Implant supported fixed prosthesis**		• Bilateral and anterior-posterior simultaneous contacts in centric relation and MIP. • For occlusal contacts, wide freedom (1-1.5mm) in centric relation and MIP • Anteriorly placed working contacts to avoid posterior overloading • Infraocclusion (100 mm) on a cantilever unit- to reduce fatigue and technical failure of the prosthesis. • Canine guided occlusion increased a potential risk of screw joint failure at the canine site due to stress concentration on the area
		a) opposing natural dentition	Group function(widely accepted) Mutually protected with shallow anterior guidance(recommended)	
		b) opposing a complete denture	Bilateral Balanced	
2	Edentulous	**Implant supported Over denture**		• At least three point balance on lateral and protrusive excursion. • Increase vertical dimension and alter plane relation to allow for vertical space for attachment housings and metal framework space if necessary. • Decrease vertical dimension if interarch distance is excessive and poses a biomechanical risk. • Keep attachment height minimal to avoid unfavorable torquing moments on implants. • Horizontal axis of rotation of the denture base round anterior attachments is purported to reduce distal cantilever effect on loading of distal denture saddles. This and a lack of indirect retention causes distal denture displacement on anterior closure increasing need for protrusive balance. • With anterior and posterior implant supported attachments, enhanced retention and resistance reduces the need for balance to prevent distal base displacement.
		a)for normal ridges	Bilateral Balanced with lingualized occlusion	
		b) severely resorbed ridges	Monoplane occlusion	

Sr. No.	Edentulous classification	Type of prosthesis	Optimal Occlusal Scheme	Additional guidelines
3	Class III or IV partially edentulous	**Free standing FPD**	Group function	• Anterior guidance in excursions and initial occlusal contact on natural dentition discluding the posterior implant supported segment when possible. • Reduced inclination of cusps, centrally oriented contacts with a 1- 1.5mmflat area, a narrowed occlusal table(by around 30%), and elimination of cantilevers • Additional implants in the maxilla could provide tripodism to reduce overloading and clinical complications.
4	Class I or II partially edentulous (in posterior region)	**Free standing FPD**	Mutually protected Group function (when anterior teeth are periodontally compromised	• Axial positioning and reduced distance between posterior implants (min of 3mm) • The utilization of cross-bite occlusion with palatally placed posterior maxillary implants can reduce the buccal cantilever and improve the axial loading • If the number, position, and axis of implants are questionable, natural tooth connection with a rigid attachment can be considered to provide additional support to implants. • Lone-standing self-supporting implant segment is preferable. • Infra-occlusion on cantilevered section with Mesial cantilever being biomechanically more favorable than a distal cantilever.

Also utilization of cross-bite occlusion and a reduced length of cantilever in bucco-lingual and mesio-distal dimension with a maximum of 15mm in mandible and 10-12mm in maxilla have been suggested as factors to consider when establishing implant occlusion.

In cases with compromised quality of bone/ Grafted bone

- Longer healing time.
- Progressive loading by staging diet and occlusal contacts/materials
- It is suggested that soft diet and reduction of the buccolingual, occlusal surface need to be considered in unfavorable loading conditions, such as immediate loading, initial healing phase, and/or poor bone quality.

Conclusion

The objectives of implant occlusion are to minimize overload on the bone–implant interface and implant prosthesis, to maintain implant load within the physiological limits of individualized occlusion, and finally to provide long-term stability of implants and implant prostheses. To accomplish these objectives, increased support area, improved force direction, and reduced force magnification are indispensable factors in implant occlusion.

In addition, systematic, individualized treatment plans and precise surgical/ prosthodontic procedures based on biomechanical principles are prerequisites for optimal implant occlusion. Implant occlusion should be re-evaluated and adjusted, if needed, in a regular basis to prevent from developing potential overloading on dental implants, thus providing implant longevity.

REFERENCES:

1. R J Chapman, Principles of occlusion for implant prostheses: guidelines for position, timing and force of occlusal contacts. Quintessence Int 1989; **20:**473- 480
2. Yongsik Kim, Tae-Ju Oh, Carl E. Misch et al, Occlusal considerations in implant therapy: clinical guidelines with biomechanical rationale, Clin. Oral Impl. Res. 2005; **16:** 26–35

3. MD Gross, Occlusion in implant dentistry. A review of the literature of prosthetic determinants and current concepts, Australian Dental Journal(1 Suppl): 2008; **53**: S60– S68

4. Sumiya Hobo Eiji Ichida, Osseointegrataion and Occlusal Rehabilitation, Quintessence Publishing Company. Ideal occlusion, pp 315-328

5. H T Shillingburg, Fundamentals of Fixed Prosthodontics, 3rd edition; Fundamentals of occlusion, Pp 11-24

6. Dawson PE ,Evaluation ,Diagnosis and Treatment of Occlusal Problems :A textbook of Occlusion. 2 nd Edition ,St.Louis,C V Mosby Co. 1978. pp274-297

7. Gunnar E. Carlsson ,Dental occlusion: modern concepts and their application in implant prosthodontics ; Odontology 2009; **97**:8–17

8. Iven Klineberg , Dianna Kingston and Greg Murray ,The bases for using a particular occlusal design in tooth and implant-borne reconstructions and complete dentures , Clinical Oral Implants Research, June 2007; **18**, Issues3, Pages 151-167

Living Legends

Name : **Dr. Sastry K.A.R.H.**
Father's Name : Late Dr.K.V.Raghava Rao Dentist
Mother : Saraswathamma
Sex : Male
Age : 69 Yrs.
Date of Birth : 8th. September 1940
Place of Birth : Machilipatnam - Andhra Pradesh. - INDIA
E-Mail : drkarh_sastry@yahoo.com

ACADEMIC QUALIFICATIONS

B.Sc - Andhra University - 1958 , Hindu College, Machilipatnam

B.D.S - Calcutta University - 1962, Calcutta Dental College & Hospital , Calcutta.

M.D.S - Oral Pathology & Microbiology - 1967, University of Bombay, Government Dental College & Hospital, Bombay.

PROFESSIONAL EXPERIENCE : Teaching After MDS

Prof. & Head, Department of Oral Pathology & Microbiology
Meghna Institute of Dental Sciences, Nizamabad
Mar 2009 to todate

Prof. & Head, Department of Oral Pathology & Microbiology
Kamineni Institute of Dental Sciences, Narketpally
Feb 2007 to 13st Aug 2008

Principal, Prof. & Head, Department of Oral Pathology,
Kamineni Institute of Dental Sciences, Narketpally
23-6- 2001 to 30-9-2005

Associate Dean, Professor, Head of the Dept.& Post graduate guide in Oral Pathology. College of Dental Surgery, MAHE(Deemed University) Mangalore.
14-8-1987 – 9-3-1998.

Asst. Prof. in Oral pathology
College of Dentistry, King Saud University,
Riyadh, Kingdom of Saudi Arabia.
15-11- 1979 – Sep 1985.

Asst. Prof. of Dental Surgery. -
A.P State Medical Services, Guntur Medical College, Guntur.
20-6- 1973 – 31-5-1975.

Asst. Prof. (Lecturer)of Oral pathology. –
A.P State Medical Services, Dental Wing, Osmania Medical College, Hyderabad.
12-2-1968 – 19-6-1973.

RESEARCH - PUBLICATIONS

Several Papers in International Journals

RESEARCH-Areas Concentrated on:

1. Vasculature and Mast cells in Oral Submucous Fibrosis
2. Beta carotene control of DMBA carcinogenesis.
3. Zinc,Copper and Zinc - Copper ratio in DMBA Carcinogenesis.
4. Immunologic profiles in DMBA Carcinogensis.
5. Assessment of mast cell populations in DMBA carcinogenesis in rat submandibular salivary and its control with Beta - carotene.
6. Evaluation of Acid & Neutral Mucopolysaccharides in DMBA carcinogenesis in rat submandibular salivary gland and its control with Beta - carotene.
7. Quantitative estimation of AgNORs in oral normal, dysplastic and carcinomatous lesions.
8. A novel objective approach towards standardization of Epithelial dysplasia Index.
9. Quantitative and qualitative evaluation of AgNORs in Odontogenic cysts and tumors.

HONORARY POSITIONS HELD

1. Member Board of studies,Osmania University - 1969 - 73
2. Vice President - IDA - A.P State - 1972 - 73
3. Secretary - A.P Civil Asst.Surgeons Assn.Guntur - 1974
4. Academic Advisor -College of Dentistry-Riyadh -1982 - 85
5. Member Audiovisual & Stores Committee - College of Dentistry – Riyadh - 1982 - 85
6. Member Board of studies,Bangalore University - 1990 - 93
7. Fellow of - Academy of General Education-Manipal - 1987
8. Dental Council of India - Inspector for MDS examiantions
9. Member Board of Studies - MAHE