Review Article

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Implant Occlusion in Various Situations for Completely Edentulous Arch

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ABSTRACT

Background: Considerations of various biomechanical factors are needed for Dental implants. Also, with one among the factors for long-term implant success being "occlusion," it becomes crucial for the practitioner to be versed with the various ideas while rehabilitating with an associated implant prosthetic device. All attempts should be made to decrease the overload and harmful forces on implants specially during mandibular movements. The occlusal rehabilitation schemes for implant-supported prostheses are derived from the occlusal scheme for natural dentition. Fully edentulous-fixed prosthesis and implant supported overdentures are the options available for a completely edentulous arch to be rehabilitated using an implant prosthesis.

Keywords: Biomechanical, guidelines, implant, occlusal scheme, occlusion.

INTRODUCTION

The proposed work of implant-supported prosthesis is to restore missing teeth and lost elements of the dentition. This prosthesis also tries to restore form, function and aesthetics and to optimize the longevity of the restored or remaining dentition. Implants need to be properly planned and inserted to support the functional as well as the parafunctional requirements of occlusal loading1. There is always a risk of implant failure as result of peri-implant crestal bone loss. This process usually occurs due to biological or biomechanical causes. Occlusal overload is an important biomechanical factor. Improper occlusion, together with extensive facial muscular forces, endorse a non-acceptable biological stress around the implant components and bone implant interface causing an overload implant, which leads to stress fractures, fatigue, cement breakdown and screw loosening. Therefore, conventional occlusal concepts need to be adapted in prosthetic treatments which are supported by dental implants2.Occlusal restorative concepts which are being evolved through complete denture and fixed tooth-supported reconstructions needs to be rethought with the continuing development and recent advances in implant dentistry. The occlusal scheme choice for implant-supported prosthesis is broad and is controversial. Most of the concepts are based on those which are developed with natural

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dentition and are later transposed to implant support systems with a few modifications. Moreover, it has been recognized that the clinical success and longevity of implants can be achieved by biomechanically controlled occlusion[3].

Occlusal guidelines for different clinical situations.

completely edentulous considerations

Original ‘‘ad modum Branemark’’ designs with interforaminal mandibular implant distribution and premaxillary distribution with distal cantilevers showed high long-term success rates and often imitated the shortened dental arch. Extended alternatives such as sinus augmentation and an increased number of posterior implants permit more posterior abutments with the anterior segment being supported with canine to canine pontics. This assists greater aesthetic control but may create an extended anterior cantilever. Alternative options of 4, 5, 6, 8 or 10 implants per arch are practiced and build treatment planning dilemmas between minimal and maximal options. Decision making for treatment planning should be based on psychosocial, psychophysiological and economic patient-specific factors and governed by patient informed preferences for the available options. The urgent need for high level long-term outcome studies for suitable evidence-based planning and determination of prognosis, has never been more pressing to this effect. In completely edentulous planning, the interaction of skeletal relations, residual ridge relations, vertical dimension, supporting anatomy, inter-arch distance and aesthetic factors of occlusal plane orientation, tooth display and lip support are significant determinants for planning implant positioning, support and occlusal scheme design. In advance their interaction must be recognized with the appropriate application of diagnostic preparations to facilitate radiographic and surgical guides. All cases must be planned in accordance with their own particular combination of individual clinical determinants. The implant treatment objectives must be restoring and maintaining, health, form, function, comfort and aesthetics. The guiding principles of occlusal restoration should be to form an suitable posterior occlusion to support forces of mastication, swallowing and occlusal parafunction, at an optimum occlusal vertical dimension. There should be excursive guidance which is appropriate to the planned supporting base of integrated dental implants1.

If the opposing arch is a complete denture, in case of a full-arch fixed prosthesis, bilateral balanced occlusion is recommended. When opposing natural dentition or a full-arch fixed prosthesis group function or mutually protected occlusion with shallow anterior guidance is recommended. The cantilever should not be having any working side and balancing contact. The infraocclusion of the cantilever segment should be within 100 µm and freedom in centric should be 1-1.5 mm. Bilateral balanced occlusion or lingualized occlusion should be used in case of over-dentures. Monoplane occlusion should be used in case of severely resorbed ridges. In case of the fully edentulous maxilla, whether the mandibular rehabilitation is done on an over-denture supported on two implants or on a mucosal-implant supported overdenture (four implants with a bar attachment), a balanced occlusal scheme (bilateral/ lingualized/monoplane) is recommended. A group function or mutually protected occlusion is recommended in case of the fully dentate maxilla and implant-supported prosthesis.

Fully edentulous – fixed prosthesis

Number of implants per jaw is disputed. Maxilla: 6–8 implants is acceptable, four implants controversial, ten and additional may be regarded as over treatment. In mandible: 5–8 implants are acceptable, 3–4 implants disputatious, ten and additional may be regarded as over treatment. The number of implants in the edentulous premaxilla also varies according to the arch form for example in case of square 2 implants in canines, for Ovoid 3 implants(2 in canines and one incisor) and for tapering arch form 4 implants(2 canines and 2 incisors) and for posteriors a minimum of 4 implants is indicated so as to increase the A-P spread.4

Angulation of implants must follow standard paradigms of axial inclination at right angles to plane of occlusion. More than 30 degree inclination is still in dispute for giving potential support and biomechanical distinction between mesio-distal and bucco-lingual inclinations.

Occlusal vertical dimension are first determined as per conventional complete denture standards. These may have to be changed by individual clinical determinants of aesthetic view at rest and smiling, display of occlusal plane , lip support, crown height space, crown: implant ratio, interarch distance and inter-ridge relations.

Cantilevers: Distal cantilevers of 1 premolar unit is considered as safe however more than 1 premolar unit is disputatious. The 2 implants adjacent to the cantilever provide compressive resistance to load and any further additional implants do not take part or help in load distribution. Mesial cantilevered anterior segment becomes biomechanically unfavorable once it is extended considerably anterior to the foremost mesial of the posterior supporting implants.

Splinting cross-arch versus segmental to give the composite resistance for supporting structures to lateral vectors of functional and parafunctional loading are provided by cross-arch splinting which is considered as a standard paradigms. A study using strain gauge showed no distinction between cross-arch and segmental splinting for both removable and fixed superstructure. According to some literature it says that splinting will increase the bending moments which is still controversial. If the ratio of Crown and implant is more than 1:1 then there is increased chance of biomechanical risk so in order to reduce the risk we have to minimize the vertical overlap and flatten the guiding cusp inclines. Occlusal schemes are dependent on case specific individual clinical determinants-ICDs (Implant distribution, occlusal vertical dimension, skeletal relation, interarch distance, crown implant ratio, aesthetic occlusal plane orientations, lip support etc.).

As per the individual clinical determinants the protrusive guidance should be kept as flat as possible. The flat protrusive group function or the anterior disocclusion will depend on ICDs. Working guidance as group function with optimum load distribution and flattened guiding inclines should separate non-working contact1.

Implant-retained overdentures.

Conventional complete denture paradigms should be used for considering the individual clinical determinants i.e. ICDs. In the upper jaw the connected implants with bar versus single stud attachments is still controversial. Stud retained segments may be built as tissue supported with proper relief whereas Bar retained components are implant supported.

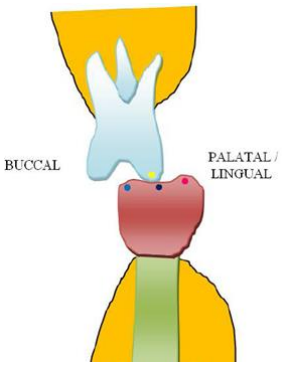
In order to prevent the denture base displacement in the final gliding occlusal phase of mastication following bolus reduction balanced occlusion is recommended. The need to achieve full balance may be modified suitably if the attachments prevent denture base displacement. In order to facilitate bilateral balance occlusion, we may consider for Lingualized occlusion. For a complete overdenture opposing the natural dentition, balance is often technically difficult to bring about. It is important to try and achieve atleast a minimum of 3-point balance on lateral and protrusive excursion. If it is required, then an increase in vertical dimension and alter plane relation is done as to permit for vertical space for attachment housings and metal framework. If the interarch distance is excessive and might lead to biomechanical risk then the vertical dimension should be decreased. In order to avoid unfavorable torqueing moments on implants the attachment height should be kept at minimum. Horizontal axis of rotation of the denture base round anterior attachments is intended to minimize the distal cantilever effect on loading of distal denture saddles and also due to the absence of indirect retention there is a distal denture displacement on anterior closure which causes an increasing need for protrusive balance with anterior and posterior implant supported attachments. In order to avoid the distal base displacement, there should be an increase in retention and resistance form and which in turn decreases the need for balance[1].

Summary of clinical applicability of occlusal schemes in implantology[2]:

CLINICAL SITUATION	OCCLUSION PRINCIPLES
Implant-supported fixed prosthesis	Bilateral balanced occlusion when the antagonist is a conventional full denture Group function or occlusion mutually protected antagonist on natural teeth Infraocclusion below the

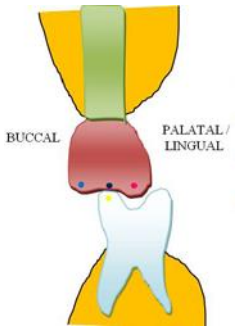
	cantilevered segment Freedom movement in centric movements
Implant-supported overdentures	Bilateral balanced occlusion Lingualized or monoplane Occlusion
Parafunctional	Shorter cantilever, proper location of fixture along the arch, and night guard.
Poor bone quality	Increase healing time Gradual increase of occlusal loading

Maxillary natural tooth vs mandibular implant-supported prosthesis in division a bone[3].



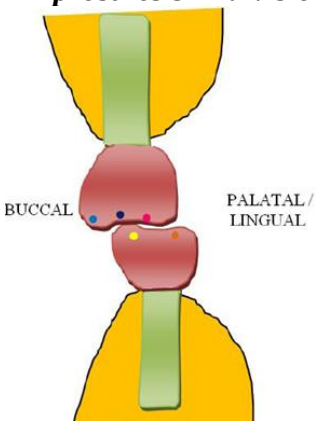
- Maxillary lingual cusp-primary contacting cusp.
- Central fossa of implant crown broadened by 2-3mm to receive the primary cusp contact from maxillary natural tooth.
- Lingual cusp of mandibular implant crown placed out of occlusal contact to eliminate offset loads. The width of lingual cusp prevents tongue entrapment between occluding surfaces.
- Mandibular buccal cusps reduced in height (to reduce offset load) and width (to prevent cheek entrapment)

Maxillary implant-supported prosthesis vs mandibular natural tooth in division a bone[3].



- Mandibular buccal cusp
- Central fossa of implant crown broadened by 2-3mm to receive the primary cusp contact from mandibular natural tooth
- Lingual cusp of maxillary implant crown placed out of occlusal contact to eliminate offset loads
- Maxillary buccal cusps maintain esthetics where required and prevent cheek bite.

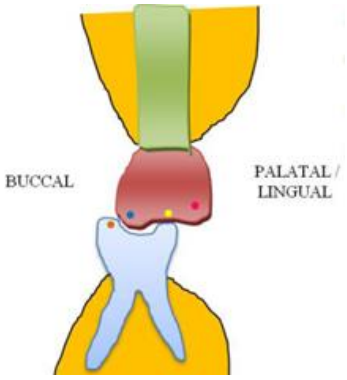
Maxillary implant-supported prosthesis vs mandibular implant-supported prosthesis in division a bone[3].



- Mandibular buccal cusp of implant crown maintains the primary occlusal contact.
- Widened central fossa of maxillary implant crown to receive primary occlusal contact
- Maxillary buccal cusps maintain esthetics where required and prevent cheek bite.
- Lingual cusp of mandibular implant crown placed out of occlusal contact to eliminate offset loads. The width of lingual cusp prevents tongue entrapment between occluding surfaces.

- Lingual cusp of maxillary implant kept out of occlusal contact and reduced width

Maxillary implant-supported prosthesis vs mandibular natural tooth in division b-d bone, might require cross-arch relation of teeth[3].



- Maxillary lingual overjet prevents tongue bite
- Mandibular buccal overjet prevents cheek bite
- Primary occlusal contact over central fossa over implant body
- Reduced width of maxillary buccal cusp (cross bite)

CONCLUSION

A poor selection of occlusal scheme can lead to biological and mechanical complications. The various consequences that can be encountered are implant failure, early crestal bone loss, screw loosening, cementation failure, component failure, porcelain fracture, prosthesis fracture, and peri-implant disease. The realization of an individualized treatment plan with surgical and prosthetic procedures based on biomechanical principles are a prerequisite for successful treatment. In addition, periodic checks and occlusal adjustment made in them are essential to the success of treatment.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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