



IMPLANT IN ESTHETIC ZONE: COMPLICATION AND MANAGEMENT

Dr. Aatika Islam

Dr. Shalabh Kumar

Dr. A. P Nirmal Raj

Dr. Dhiren Sanjeev Shah

ABSTRACT

Osseointegration is not the only sign for successful dental implant, esthetic is one of the main criteria for it. In today's modern dentistry, implants are mostly use in restoring partially or fully edentulous patients. Success of implant is difficult to obtain as there are many complication which occur during and after placement. Anterior region is the esthetic concerned area, where many complications can be seen. So this article focuses on the complications that occur in esthetic zone including the management of each complication.

KEYWORDS :

INTRODUCTION

The basic aim of modern dentistry is to restore patient's comfort, health, esthetics, normal contour, speech and functions either by removing caries or replacing the lost teeth. Now a days, dental implants are broadly used in replacing missing teeth.

Several factors leading to increased use of implants include (1) age related tooth loss, (2) implant-supported restorations advantages, (3) removable partial dentures effect, (4) increasing awareness in public, (5) unsatisfactory performance of removable prostheses, (6) psychological aspects of tooth loss and needs, (7) effect of fixed prosthesis failure, (8) demographic population living longer, (9) expected durable results of implant-supported prostheses and (10) effect of edentulism.

Use of implants for restoring the partially or fully edentulous patients leads to many complications. Thus managing complication is now becoming topic for clinicians. So to prevent such complications, it is very important to know the cause¹.

There are four factors that impact the treatment outcome of implant therapy and lead to Implant complications (fig1)².

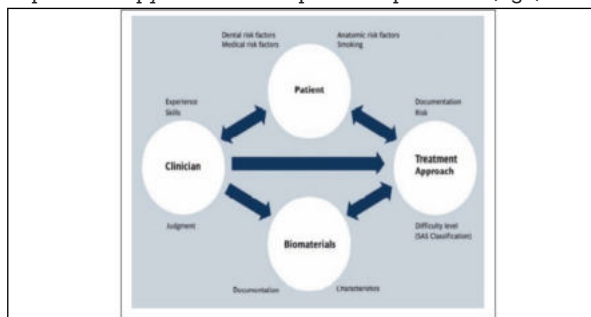


Fig 1: Diagram illustrating the interrelationship between the four principal factors that impact the implant therapy outcome.

Clinician or dentist play important role in preventing complication for implant placement in post-extraction sites, described by Buser and Chen².

Esthetic complications occur because of an ill-suited implants size/ number, malpositioned implants, periimplant bone destruction which is caused by a peri-implant infection or deficiencies already present in the alveolar process.

Esthetic Complications

A. Implant Malpositions

In order to achieve an anticipated treatment outcome, placement of implant follows two principles i.e biological and prosthodontics needs. In 2003, the "comfort zone and danger zone" concept was coined for implants placement in the aesthetic zone. Also, the concept of correct 3D implant position was developed during that period of 3rd ITI Consensus conferences³.

The concept of comfort and danger zones tell us about the issue that we face if implants are not placed in correct positioned adjacent to the natural teeth. This concept was defined in three directions; orofacially, mesiodistally and coronopically.

A. Orofacial Malposition

There are two different complications caused by malpositioning of Orofacial implant. The first complication might be caused by placing the implant too far palatally, leading to ridge lap of crown. This complication not always causes esthetic problem, it basically causes plaque accumulation because patient find difficulty in maintaining oral hygiene, infact as implant is placed too palatally which increase crown's dimension on palatal side leading to impinging the crown on the tongue space (fig 2)⁴.

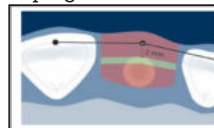


Fig 2: In the orofacial plane, the facial extent of the implant shoulder is about 1.5-2 mm orally to the point of emergence of the adjacent teeth (within the green comfort zone).

When implant is placed too far facially it cause the second complication i.e recession of the facial mucosa which leads to severe esthetic problems, this can be seen in fig 3(a,b)⁵.



Fig 3⁴: (a) Severe recession of the mucosa has occurred due to a facial malposition of the implant in the upper left central incisor site. (b) CBCT scan of the implant showing the facial

Recession is generally seen in patients with immediate implant placement. Many retrospective and prospective clinical studies file that placing implant immediately after extraction showed us with an increased risk for mucosal recession^{6,7,8,9,10,11}.

B. Mesiodistal Malposition

Placing implants too close to natural tooth come under mesiodistal danger zone (fig 4)⁸, lead to crestal bone resorption and modeling which cause reduced papilla height of adjacent tooth⁴. Therefore, it is said that at least 1.5mm of distance should be maintain from adjacent tooth.

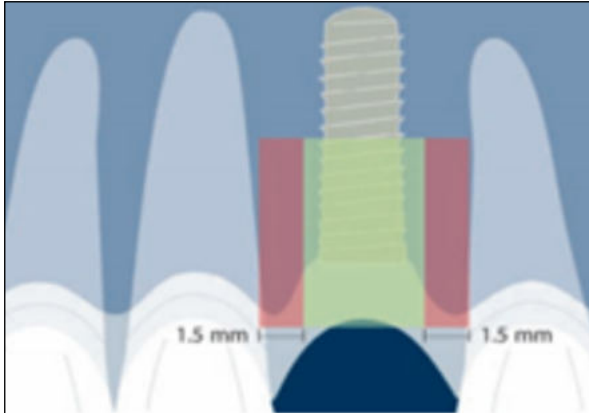


Fig 4: The concept of "comfort" and "danger" zones for the position of implants in relation to the adjacent natural teeth. In a mesiodistal dimension, the implant should be positioned within the comfort zone (green zone). The danger zone is 1.0–1.5 mm wide.

The condition or the cases where oversized implants are placed, therefore less space is left in between adjacent tooth causing incomplete absence of papilla, leading to esthetic problems. Also, there are situation where correct shoulder diameter has been selected for available space but some local anatomical structures like nasopalatine canal in anterior region specifically near central incisor site may result into placement of implant too close to an adjacent tooth causing loss of papilla (fig 5).



Fig 5: Due To The Location Of The Nasopalatine Canal, This Implant Has Been Placed Too Close To The Adjacent

C. Coronoapical Malposition

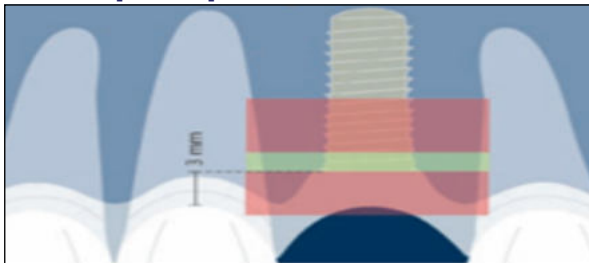


Fig 6⁴: Apico-coronally, the implant shoulder should be positioned about 3 mm apical to the gingival margin of the contralateral tooth in patients without gingival recession. The danger zone is entered when the implant shoulder is placed too deeply, or too coronally in relation to the comfort zone (green zone).

This malposition of implant causes problem in esthetic region, if implant is placed too coronal or if it is not inserted deep into the tissues, it may cause a displeasing result because of the visible implant metal shoulder. And if the implant is extended far downward which is mainly seen in immediate (type 1) implant. This placement of implant causes recession of facial mucosa. The deep placement of an implant might lead to constant inflammation of the peri-implant mucosa, adequate plaque control difficulty, and a poor soft tissue esthetic outcome. In the early 1990s it was suggested to place Branemark-type implants 3–4 mm below the cement-enamel junction (CEJ) of adjacent teeth¹². Coronoapical position causes recession was first reported in a clinical study by Small and Tamow¹³.

• Axis Problems With Endosseous Implant

Axis problem is generally caused when implant is not placed in the central axis or within the comfort zone, if it is placed too facially it causes facial mucosal recession. If axis problem is minor and the shoulder of implant lie within the comfort zone it can be corrected using angled abutment.

• Papillary Deficiencies

Papillary deficiencies cause failure of soft tissue in anterior region¹⁴. It is very difficult to regain the lost or spoiled papilla. Papillary deficiencies is generally caused by thin periodontium, misplaced implants too close to adjacent tooth, already present crestal bone loss, triangular tooth form, problem with adjacent implants and trauma which is caused during extraction.

A. Angulation Issues

Angulation of implant is control by drill's course as move into the bone. Regarding implant angulation, it is suitable to set up a balance between anatomic concerns and prosthetic^{15,16,17}. Two types of angulations issue are there mesiodistal angulation issue and buccolingual angulation issue.

• Buccolingual Angulation Issues

While drilling for implant placement there can be minor misangulation (0-15 degree) or severe misangulation (>25 degree). Misangulation upto 15 degree can be managed by available prefabricated abutments which are available in 0-15 degree configuration. When there is severe misangulation use of custom cast is preferred. For correcting the buccolingual angulation issue running room also called crevicular room is of great concern. When there is not enough crevicular space and implant is not placed apically enough metal shoulder of implant is visible which will create esthetic problem.

Angulated abutment should not be loaded with more stress. If more stress is applied it will lead to fracture of coronal aspect of an implant, abutment screw loosening, and even screw fracture^{18,19}. Additional implant is recommended in where severe angulation issue cannot be bypassed.

• Mesiodistal Angulation Issue

This type of angulation issue interfere with the adjacent tooth and its related structures such as sinus and foramen. If the angulation is minor it can be slightly corrected but if angulation is severe, it is necessary to the immerse implant or to remove it. Angulated component is generally use to provide parallelism between abutments when misangulated implants are there causing abnormal path. Sufficient crevicular room is needed when correcting angulation issues to provide acceptable prosthetic result. Sometime failure happens when the restoration require a circumferential ridge lap or is surrounded by large gingival embrasure, which may result in food impaction and difficulty in cleaning. Adding on the complication esthetic complication is seen over here when the metal abutment is being exposed due to inadequate running

room. Prostheses which is being fabricated on this misangulated issue result to mechanical failure due to additional forces.

• Apico-Occlusal Issues (Sink Depth)

Apico-occlusal issue which is also called sink depth, it is the position of implant which is satisfactory mechanism for angulation and positional issue. Factors which must be considered before planning for apicocoronl location of implants are implant malpostion, misangulation, interocclusal clearance, tissue thickness and bone level.

Implant malpostion and misangulation is being discussed earlier

• Interocclusal clearance

Interocclusal clearance is a very supreme factor which should be taken care, this can be evaluated by analysing the study cast before implant surgery. Components that compromise the interocclusal space are with dimension of 2mm for occlusal clearance between the opposing tooth and abutment, 0.5mm for abutment collar to interfere with implant and 4.5mm "prep" length, which conclude excellent parallelism^{20,21,22}. A screw-on restoration can be fabricated, if there is reduced interocclusal space²³. Selective grinding of opposing dentition or opening the bite sometimes gives the prosthetic space.

• Gingival Tissue Thickness

One of the best ways for measuring the depth of implant in relation to gingival margin is by periodontal probe. If the gingival margins are thick they may result in deep probing which give the idea of implant and its placement. Thick gingival margin lead to deep probing depth which may be associated with mucositis. Abutment with longer transgingival section is recommened for thick margins. Other complication that occur because of thick margins is complete seating of prostheses.

• Bone Level

Implants that are placed on resorbed ridges, have shallow crevice but remain in the apical position relative to an adjacent tooth or implant^{24,25,26}. If implants are placed in these areas dissimilarity of gingiva may be present between implant and the adjoining tooth, which leads to uneven gingival form. If the restoration is within this may hide the uneven gingival height²⁷. Other treatment is the fabrication of long clinical crown.

To attain adequate prosthetic result, the use of CT scan and use of surgical guide or template is useful for missing hard and soft tissue. If such deformities create a problem esthetically for the patient, it should be discussed and described to the patient at the time of diagnostic and presurgical phases of treatment.

Treatment Of Esthetic Complications

Fortunate treatment of esthetic complications cause by implant malposition is usually decide by the size of the implant and the degree of malposition. Treatment of different malposition are as follows.

• Reducing The Diameter Of The Implant Platform

Oversized implant can be carefully be reduced by preparing the shoulder of the implant that too less than 0.5mm proximally, so the possibility of reducing mesiodistal dimension is restricted and this technique is only possible for tissue-level implants

• Soft Tissue Grafting

Malposition of the implant causes the loss of papillae or recession of facial marginal mucosa which is the main esthetic complication. Loss of papillae is the situation which

cannot be corrected but with the help of soft tissue graft recession can be corrected.

Two approaches are used to correct recession, first approach, connective tissue is grafted to the implant facial surface. Connective tissue is harvested from the palate, coronally advanced facial flap is used to cover graft. Here in this approach the crown need not be removed from abutment.

The second approach, removal of crown and abutment and the use of soft tissue graft. Reopening procedure is done here to restore the connection of abutment and crown.

Soft tissue grafting cannot reverse recession when implant malpostion is sufficiently great.

• Implant Removal And New Implant Treatment

This stage of treatment arises when the implant malposition is not treated by soft tissue grafting. Removing the placed implant is very challenging procedure for the dentist, because it causes further bone loss, so trephines are contraindicated. Now in recent and advanced years special implant-removal torque system have been developed.

One of this implant removal system is BTI Implant Extraction Kit. This system is used in daily practice to remove osseointegrated implants²⁸. If during time of removal there is lack of keratinized mucosa, it can be treated by placing the soft tissue graft during implant removal and new implant placement surgery. During this surgery restoration of facial bone is needed this can be done with the help of GBR (guided bone regeneration) technique. This technique is often done when there is two-wall defect²⁹. One wall defect is corrected by using autogenous block graft combined with collagen membrane and implant is placed later after 5-6 months³⁰. This treatment is often result in compromised esthetic outcome.

CONCLUSION

Within the edentulous or alveolar ridge spaces, the contemporary field of implantology is equipped with esthetic implant therapy as an advanced treatment modality to achieve an ideal outcome of functional treatment and esthetics.

Despite all the advances and clinical successes observed in numerous patients, the overall success and longevity of the therapeutic techniques used in esthetic implants cannot be determined due to insufficient scientific support from well controlled and long term studies. This generates an immediate need for a standard prosthetic and surgical protocol for the esthetic implant therapy; to standardise methodologies for each clinical procedure and situation against evidence based protocols.

Esthetic success can be predicted by determining the tissue loss at the beginning of the treatment; the success factor to deliver an ideal esthetic result reduces if soft tissue and bone loss is high. A greater degree of predictability comes with single tooth implants, since the morphological substructure required for restoring the natural papillary and gingival architecture is provided by the adjoining teeth. However, a greater challenge comes in the esthetic zone with replacing multiple missing teeth with deficient three dimensional architecture of the existing soft tissues and bone. The dental implant placement in the esthetic zone has no margin for error, and is critically a technique sensitive procedure. There are several guidelines for therapeutic modalities and ideal implant positioning that can be used for replacing missing teeth and addressing different clinical situations in the esthetic zone.

REFERENCES

1. Buser D, Chen S. Esthetic complications due to implant malpositions: etiology, prevention, and treatment. *Dental Implant Complications: Etiology,*

- Prevention, and Treatment, Second Edition. Edited by Stuart J. Froum. © 2016 John Wiley & Sons, Inc. Published 2016 by John Wiley & Sons, Inc
2. Buser D, Chen S. Factors influencing the treatment outcomes of implants in post-extraction sites. In: Buser D, Wismeijer D, Belser U, eds. ITI treatment guide, Vol. 3, Implant placement in postextraction sites – treatment options. Berlin: Quintessence, 2008: 18–28.
 3. Buser D, Martin W, Belser UC. Optimizing esthetics for implant restorations in the anterior maxilla: anatomic and surgical considerations. *Int J Oral Maxillofac Implants* 2004; 19 (Suppl): 43–61.
 4. Brägger and Heitz-Mayfield, 2015. In: ITI treatment guide, Vol. 8: Biological and hardware complications in implant dentistry, Wismeijer et al., eds. Berlin: Quintessence Publishing. Reproduced with permission from Quintessence
 5. Esposito M, Ekström A, Grondahl K. Radiological evaluation of marginal bone loss at tooth surfaces facing single Branemark implants. *Clin Oral Implants Res* 1993; 4: 151–7.
 6. Chen ST, Darby IB, Adams GG, Reynolds EC. A prospective clinical study of bone augmentation techniques at immediate implants. *Clin Oral Implants Res* 2005; 16: 176–84.
 7. Lindeboom JA, Tjiook Y, Kroon FH. Immediate placement of implants in periapical infected sites: a prospective randomized study in 50 patients. *Oral Surg Oral Med Oral Pathol Endodontol* 2006; 101: 705–10.
 8. Chen ST, Darby IB, Reynolds EC. A prospective clinical study of non-submerged immediate implants: clinical outcomes and esthetic results. *Clin Oral Implants Res* 2007; 18: 552–62.
 9. Kan JYK, Rungcharasseng K, Sclar A, Lozada JL. Effects of the facial osseous defect morphology on gingival dynamics after immediate tooth replacement and guided bone regeneration: 1-year results. *J Oral Maxillofac Surg* 2007; 65: 13–19.
 10. Evans CJD, Chen ST. Esthetic outcomes of immediate implant placements. *Clin Oral Implants Res* 2008; 19: 73–80.
 11. Chen ST, Darby I, Reynolds EC, Clement JG. Immediate implant placement post-extraction without flap elevation: a case series. *J Periodontol* 2009; 80: 163–7
 12. Parel SM, Sullivan DY. Esthetics and osseointegration. University of Texas Health Sciences, 1989.
 13. Small PN, Tarnow DP. Gingival recession around implants: a 1-year longitudinal prospective study. *Int J Oral Maxillofac Implants* 2000; 15: 527–32.
 14. Sullivan D, Kay H, Schwarz M, Gelb D. Esthetic problems in the anterior maxilla. *Int J Oral Maxillofac Implants*. 1994;9(suppl):64-74.
 15. Greenstein G, Cavallaro J, Romanos G, Tarnow D. Clinical recommendations for avoiding and managing surgical complications associated with implant dentistry: a review. *J Periodontol* 2008; 79: 1317–29.
 16. Greenstein G, Cavallaro J, Tarnow D. Practical application of anatomy for the dental implant surgeon. *J Periodontol* 2008; 79: 1833–46.
 17. Ten Bruggenkate CM, Krekeler G, Kraaijenhagen HA, Foitzik C, Oosterbeek HS. Hemorrhage of the floor of the mouth resulting from lingual perforation during implant placement: a clinical report. *Int J Oral Maxillofac Implants* 1993; 8: 329–34.
 18. Zarb GA, Schmitt A. The longitudinal clinical effectiveness of osseointegrated dental implants: The Toronto study. Part III: Problems and complications encountered. *J Prosthet Dent* 1990; 64: 185–94
 19. Brosh T, Pilo R, Sudai D. The influence of abutment angulation on strains and stresses along the implant/bone interface: comparison between two experimental techniques. *J Prosthet Dent* 1998; 79: 328–34
 20. Potts RG, Shillingburg HT Jr, Duncanson MG Jr. Retention and resistance of preparations for cast restorations. *J Prosthet Dent* 2004; 92: 207–12
 21. Kent WA, Shillingburg HT Jr, Duncanson MG Jr. Taper of clinical preparations for cast restorations. *Quintessence Int* 1988; 19: 339–45.
 22. Potts RG, Shillingburg HT Jr, Duncanson MG Jr. Retention and resistance of preparations for cast restorations. *J Prosthet Dent* 1980; 43: 303–8
 23. Binon PP. Implants and components: entering the new millennium. *Int J Oral Maxillofac Implants* 2000; 15: 76–94.
 24. Tallgren A. The continuing reduction of the residual alveolar ridges in complete denture wearers: a mixed-longitudinal study covering 25 years. 1972. *J Prosthet Dent* 2003; 89: 427–35
 25. Tallgren A, Lang BR, Walker GF, Ash MM Jr. Roentgen cephalometric analysis of ridge resorption and changes in jaw and occlusal relationships in immediate complete denture wearers. *J Oral Rehabil* 1980; 7: 77–94.
 26. Chan MF, Howell RA, Cawood JJ. Prosthetic rehabilitation of the atrophic maxilla using pre-implant surgery and endosseous implants. *Br Dent J* 1996; 181: 51–8
 27. Garcia LT, Verrett RG. Metal-ceramic restorations – custom characterization with pink porcelain. *Compend Contin Educ Dent* 2004; 25: 242–6
 28. Anitua E, Orive G. A new approach for atraumatic implant implantation and immediate implant installation. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2012; 113: e19–25.
 29. Buser D. Implant placement with simultaneous GBR procedures: selection of biomaterials and surgical principles. In: Buser D, ed. 20 years of guided bone regeneration in implant dentistry, 2nd edn. Berlin: Quintessence, 2009: 123–52
 30. von Arx T, Buser D. Horizontal ridge augmentation using autogenous block grafts and the guided bone regeneration technique with collagen membranes: a clinical study with 42 patients. *Clin Oral Implants Res* 2006; 17: 359–66.