



## DENTAL IMPLANTS: THE COMPLICATIONS: A REVIEW

## Health Science

**Priya Baburao Gaikwad**

BDS, Maharashtra University of Health Sciences, Nashik, India.

**Sahil Bhalla\***

BDS, Genesis Institute of Dental Sciences and Research, Ferozepur, Punjab, India.  
\*Corresponding Author

## ABSTRACT

Implant dentistry has come a long way since Per-Ingvar Branemark first presented the osseointegration of dental implants, and the use of dental implants has increased exponentially in the last three decades. It is important for the practitioner who uses implants to understand the type and frequency of complications that may arise. This current review highlights the common complications in treatments involving the use of dental implants.

## KEYWORDS

Implants, Complications, Implant fracture.

## INTRODUCTION

The introduction of endosseous dental implants as an option for restoring partially and fully edentulous patients has revolutionized dental treatment. High survival rates reported for single and multiple missing tooth replacements have validated the use of implant supported restorations as a predictable method for oral rehabilitation.<sup>1-4</sup> Dental implants have gained wide popularity over the years as they are capable of restoring the function to near normal in both partial and completely edentulous arches. However, as with any treatment modality complications will occur. Implant surgery complications are frequent occurrences in dental practice and knowledge in the management of these cases is essential. These complications may vary from minor (loose screw, chipped porcelain, peri-implant gingival inflammation) to major (implant failure, implant fracture, permanent nerve damage, and bone necrosis)<sup>5-9</sup>.

There are several reasons for the increased number of implant complications being experienced by clinicians in recent years. The aim of this present review is to discuss basic complications associated with dental implants.

## Success Criteria For Dental Implants

Before reviewing the implant complications, a brief overview is presented discussing the criteria for implant success. It is suggested that probing depths related to a fixed reference point and bleeding on probing should be measured to evaluate implant success. Several authors have expressed many criteria to assess the success of a functional implant, however this article outlines the revised criterias. The success criteria, which were initially targeted for evaluation as 5 years survival has changed. With the improved technology and understanding of the tissue behaviour the criteria are set with a target of 10-year survival rate.<sup>10,11,12</sup>

Schnitman and Schulman from National Institutes of Health proposed the criteria for implant success in 1979. This was modified by Albrektsson, Zarb, Worthington, and Eriksson in 1986 presently represented as revised criteria for implant success as follows:<sup>10,11</sup>

- Implant should be immobile clinically
- No evidence of Peri-implant radiolucency on radiograph
- Vertical bone loss less than 0.2 mm annually after 1 year of implant loading
- Absence of Persistent and/or irreversible signs and symptoms such as inflammation, pain, infections, paresthesia, neuropathies, or violation of mandibular canal.
- Success rate of 85% at the end of 5 years and 80% at the end of 10 years described as minimum criteria for success.

Further, in 1998 **Esposito et al.**<sup>12</sup> have listed out the various criteria for success which were agreed upon at the 1st European Workshop on Periodontology. According to them following were to be considered success criteria for osseointegrated implants.

- Absence of mobility
- An average radiographic marginal bone loss of less than 1.5 mm during the first year of function

- Less than 0.2 mm annually thereafter,
- Absence of pain/paresthesia

## Complications Associated With Dental Implants

The basic complications of dental implants which we have divided into three general categories: biomechanical overload, infection or inflammation, and other causes. Examples of implant fracture, loosening, infection, inflammation from subgingival cement, failure of bone and soft tissue preservation, injury to surround structures, and other complications will be briefly discussed along with overview of factors contributing and prevention strategies.

## Etiology Of Implant Complications

## Biomechanical Overload

- Implant Fracture
- Loosening
- Osseointegration Failure
- Cement Failure and Abutment Screw Loosening

## Infection Or Inflammation

- Infection
- Subgingival Cement

## Other Causes

- Bone and Soft Tissue Preservation
- Injury to Surrounding Structures
- Other Complications

## Classifications For Dental Implant Complications

Various authors have classified implant complications and implant failures depending upon several criteria.

The complications with dental implants can be classified as:<sup>13-16</sup>

**Table 1. Basic complications associated with dental implants.**<sup>13-16</sup>

Mechanical complications	Technical complications	Biologic complications
<ul style="list-style-type: none"> <li>• Prosthetic material for fatigue and failure</li> <li>• Screw loosening and fracture</li> <li>• Implant fracture (also see Table 2)</li> <li>• Fracture of restorative materials/ cement failure</li> </ul>	<ul style="list-style-type: none"> <li>• Fracture of veneering porcelain</li> <li>• Fracture of the framework in implant supported fixed partial dentures.</li> </ul>	<ul style="list-style-type: none"> <li>• Adverse soft tissue reactions</li> <li>• Bacterial infections</li> <li>• Sensory nerve disturbances</li> <li>• Progressive marginal bone loss, loss of osseointegration.</li> </ul>

**Table 2. Classification of implant complications based etiological factors**<sup>17</sup>

Treatment plan related complications	Anatomy related complications	Procedure related complications
<ul style="list-style-type: none"> <li>• Improper angulation of</li> </ul>	<ul style="list-style-type: none"> <li>• Nerve injury</li> <li>• Bleeding</li> </ul>	<ul style="list-style-type: none"> <li>• Mechanical complications</li> </ul>

<ul style="list-style-type: none"> <li>• Implant placement</li> <li>• Informed consent and proper communication of complications related to implant surgery.</li> </ul>	<ul style="list-style-type: none"> <li>• Perforation of cortical plate</li> <li>• Maxillary sinus complications</li> <li>• Adjacent tooth problems</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of primary stability</li> <li>• Mandible fracture</li> <li>• Ingestion for aspiration of implant/components</li> </ul>
---	---	--

**Table 3. Complications related to the long-term implant success are broadly classified as follows<sup>17,18</sup>:**

Surgical	<ul style="list-style-type: none"> <li>• Haemorrhage or hematoma</li> <li>• Neurosensory disturbances</li> <li>• Implant malposition</li> </ul>
Biological	<ul style="list-style-type: none"> <li>• Perimucositis and peri-implantitis</li> <li>• Dehiscence and recession</li> <li>• Lack of Osteointegration</li> </ul>
Biomechanical	<ul style="list-style-type: none"> <li>• Prosthetic material for fatigue and failure</li> <li>• Screw loosening and fracture</li> <li>• Implant fracture</li> <li>• Fracture of restorative materials</li> </ul>
Aesthetic	<ul style="list-style-type: none"> <li>• Patient with the high aesthetic expectations</li> <li>• Poor implant position</li> <li>• Deficiency in edentulous sight anatomy</li> <li>• Insufficient peri-implant bone</li> <li>• Unaesthetic crown contours and dimensions</li> </ul>
Phonetic	<ul style="list-style-type: none"> <li>• Implant prosthesis in restricted or narrow palates</li> <li>• Spaces under and around implant superstructure.</li> </ul>

**Table 4. Hobo et al.<sup>19</sup> listed out the various complications occurring in implants as follows:**

<p>1. Loss of bone anchorage</p> <p>a) Mucoperiosteal perforation</p> <p>b) Surgical trauma</p>	<p>1. Complications in Stage I surgery</p> <p>a. Mental nerve damage</p> <p>b. Penetration into a sinus, nasal cavity, or through inferior border of the mandible.</p> <p>c. Excess countersink</p> <p>d. Thread exposure</p> <p>e. Eccentric drills, taps</p> <p>f. Stripping of threads</p> <p>g. Jaw fracture</p> <p>h. Ecchymosis, more common in older patients.</p> <p>i. Wound dehiscence</p> <p>j. Facial space abscess submental, submandibular, Ludwig's angina</p> <p>k. Suture abscess</p> <p>l. Loose cover screw</p>
<p>2. Gingival problems</p> <p>a) Proliferative gingivitis</p> <p>b) Fistula formation</p>	<p>2. Complications in Stage II surgery</p> <p>a. Poor selection of fixture height</p> <p>b. Incorrect fixture placement more than 35° cannot be used prosthetically</p> <p>c. Damaged hex nut on top of fixture.</p> <p>d. Loose abutment</p> <p>e. Fractured abutment screw</p> <p>f. Early loading by prostheses</p> <p>g. Poor air-flow pattern with "high-water" design</p> <p>h. Aspiration of instruments</p> <p>i. Thread exposure</p> <p>j. Fixture fractures</p> <p>k. Excess bone resorption</p> <p>l. Plaque/calculus formation, periodontal problems</p> <p>m. Poor selection of abutment height.</p>
<p>2. Mechanical complications</p> <p>a) Fracture of prostheses, gold screws, abutment screws</p>	<p>3. Prosthetic complications</p> <p>a) Insufficient space beneath the fully bone anchored</p> <p>b) Abutments penetrate through alveolar mucosa (unattached tissue).</p> <p>c) Screw fractures: gold or abutment screws.</p> <p>d) Acrylic or porcelain fracture</p> <p>e) Posterior fixture failures in the maxilla.</p>

**Mechanical Complications**

Implant-supported single crowns and multiple implant-supported bridges may suffer from various mechanical, biological, or technical complications. (Table 1). Out of all, mechanical complications are

usually a sequel to biomechanical overloading.

Factors contributing to mechanical complications are listed as below<sup>14,15</sup>

- Poor implant position/angulation
- Insufficient posterior tooth support
- Overloading
- Inadequate bone support/ peri-implant vertical bone loss
- Excessive forces due to parafunctional habits. Eg. Bruxism.

**Screw Loosening**

Goodacre *et al*<sup>20</sup> stated that screw loosening or fracture prevailed more with the prosthetic screws as opposed to the abutment screws. The primary etiological factor for screw loosening or fracture of the implant component is biomechanical overloading of the implants usually causes loosening. Implants restored with single crowns have shown more screw loosening as compared to multiple implants with multiple restored units. Also the mandibular molar implant restorations are more affected by screw loosening as compared to the maxillary ones. In a systemic review by Pjetursson *et al.*<sup>21</sup> the yearly rate of abutment or screw loosening ranged from 0.62% to 2.29% that converts into a 5-year complication rate ranging from 3.1% to 10.8%.

Prevention strategies for Screw loosening

- Maximize the joint clamping forces while curtailing joint separation forces.

**Implant Fracture/ Screw Fracture**

Fracture of the implant abutment screw can be a major setback as the remaining fragment inside the implant jeopardizes the efficient functioning of the implant. There are two main etiological causes of implant fracture is biomechanical overloading and peri-implant vertical bone loss.<sup>22</sup> The risk of implant fracture increases when the vertical bone loss is severe enough to concur with the apical limit of the screw. Implant fractures are also attributable to flaws in the designing and manufacturing techniques of various implant systems. Implants with a smaller diameter of 4 and 3.75 mm are inclined to fractures more easily than those with the greater diameter. The various risk factors with dental implant fractures are listed below:

**Table 5. Risk factors associated with dental implant fractures<sup>23-27</sup>**

Periodontal factors	Implant factors	Prosthetic factors
<ul style="list-style-type: none"> <li>• Periodontal pocket ≥ 5mm</li> <li>• Bone loss</li> <li>• Occlusal overload (bruxism)</li> </ul>	<ul style="list-style-type: none"> <li>• Diameter less than 4 mm</li> <li>• Crown / implant greater than 1</li> <li>• Implant design</li> </ul>	<ul style="list-style-type: none"> <li>• Loosening /torsion</li> <li>• Prosthesis screw</li> <li>• Cantilevers</li> <li>• Ceramic fracture</li> </ul>

Prevention strategies for Screw fracture<sup>25,27</sup>

- Careful treatment planning
- Strategies used for better occlusal scheme
- Tightening the implant to recommended torque
- Routine follow-up.

**Cement Failure**

Biomechanical overload can also lead to Cement failure which as a consequence affects the prosthesis attachment, however is treated by recementation procedures. With the advancements in material science, particularly for luting agents, the incidence of decementation has reduced significantly. Prevention methods such as careful treatment planning and clinical criteria must be followed to avoid such incidences.

**Technical Complications**

The frequency of occurrences of technical complications is greater in implant-supported FPDs as compared to the implant-supported removable prosthesis.<sup>13,16</sup>

Factors contributing to technical complications<sup>16</sup>

- Selection of restorative material.
- Selection of impression material and impression technique.
- Positional stability of transfer posts.

**Fracture Of The Framework In Implant Supported Fixed Partial Dentures<sup>25,27</sup>**

The passive fit of the framework has been advocated as a prerequisite for successful long-term osseointegration of the implant with the surrounding alveolar bone. Whenever there is a rigid connection between the osseointegrated implant and the fixed subsequent framework, the strains are inevitably induced in every component of

the framework and the added load produces supplementary strains, further affecting the bone-implant-prosthesis assembly, which in return may lead to fracture of the framework in implant supported fixed partial dentures. To correct, the gross misfit of the abutment-superstructure relationship, cutting the framework or bar and then joining the sections by welding or soldering is highly recommended, but both the techniques may impair the original fit. Since the corrective methods usually lead to a misfit, in order to avoid the need for such corrections, it is recommended that effort must be made to improve the original/initial fit of the cast frameworks.

Prevention strategies for Fracture of the framework in implant supported fixed partial dentures.

- Detailed, careful and accurate prosthodontic procedures

### Fracture Of Veneering Porcelain<sup>25,27</sup>

Fracture of the veneering ceramic is another common complication associated with single-implant restorations. Metal-ceramic restorations are the most common types of restorations in clinical dentistry. With the passage of time, esthetic demands of the patients have risen and thus driven the clinicians to focus on all-ceramic restorations. Zirconia restorations are promising, and the material is even being used to fabricate implant abutments for cement-retained restorations or for direct veneering for screw-retained prosthesis.

Prevention strategies for Fracture of veneering porcelain

- Reduce the occlusal table
- Prevention of heavy occlusal contacts
- Shallow cuspal heights
- Adequate thickness of overlying ceramic

### Biological Complications

Biological complications are further sub classified as:

- Early or primary (before loading): failure to establish osseointegration.
- Late and secondary (after loading): failure to maintain the achieved osseointegration.

Biological complications include bacterial infections, microbial plaque buildup, progressive bone loss, and sensory disruptions. Biological complications are subcategorized into early biological failures and late implant failures, where the early failures are attributed to the failure of placing the surgical implant under proper aseptic measures and the late complications are typically peri-implantitis and infections bred by bacterial plaque.<sup>5,12,13,24</sup>

Infection represents one of many factors contributing to the failure of dental implants. Presently, no single micro-organism has been closely associated with colonisation or infection of any implant system.<sup>28,29</sup>

Failing dental implants are associated with a microbial flora traditionally associated with periodontitis. Peri-implant disease is defined as the inflammatory pathological change that takes place in the soft and hard tissues surrounding an osseointegrated implant. When an implant is successfully osseointegrated, the peri-implant disease that occurs is the consequence of disparity between the host defense and increasing bacterial load. It usually takes about 5 years for the peri-implant disease to progress and exhibit clinical signs and symptoms.<sup>9,24</sup>

<sup>30</sup>. The peri-implant disease is also related to unequal occlusal load distribution, which may lead to loosening of the superstructure, infection of the surrounding area, eventually culminating into the inflammatory process. Predisposing systemic conditions include uncontrolled diabetes mellitus, osteoporosis, smoking, long-standing treatment with steroids, uncontrolled periodontitis, radiation therapy, and chemotherapeutics.<sup>9,29</sup>

Factors contributing to biological complications<sup>17,18</sup>

- Microbial plaque buildup.
- Unhealthy biological barrier, predisposing systemic conditions.
- Unequal occlusal load distribution.

Prevention strategies for Biologic complications

- Nonsurgical mechanical debridement
- Local antimicrobial delivery
- Surgical debridement with bone grafting

### REFERENCES

1. Van Steenberghe D, Quirynen M, Calberson L, Demanet M. A prospective evaluation of the fate of 697 consecutive intraoral fixtures and modern Brånemark in the rehabilitation of edentulism. *J Head Neck Pathol* 1987; 6: 53–8.
2. Adell R, Eriksson B, Lekholm U, Brånemark P-I, Jemt T. A long-term follow up study of osseointegrated implants in the treatment of totally edentulous jaws. *Int J Oral*

Maxillofac Implants 1990; 5: 347–59.

3. Buser D, Mericske-Stern R, Bernard JP, Behneke A, Behneke N, Hirt HP, et al. Long term evaluation of non-submerged ITI implants. Part 1: 8 year life table analysis of a prospective multi-center study with 2359 implants. *Clin Oral Implants Res* 1997; 8: 161–72.
4. Wennstrom JL, Ekstedt A, Grondahl K, Karlsson S, Lindhe J. Implant-supported single-tooth restorations: a 5 year prospective study. *J Clin Periodontol* 2005; 32: 567–74
5. Esposito M, Hirsch JM, Lekholm U, Thomsen P. Biological factors contributing to failures of osseointegrated oral implants (II). Etiopathogenesis. *Eur J Oral Sci* 1998; 3: 721–64.
6. Luna AH, Passeri LA, de Moraes M, Moreira RW. Endosseous implant placement in conjunction with inferior alveolar nerve transposition: a report of an unusual complication and surgical management. *Int J Oral Maxillofac Implants* 2008; 23: 133–6.
7. McDermott NE, Chuang SK, Woo VV, Dodson TB. Complications of dental implants: Identification, frequency, and associated risk factors. *Int J Oral Maxillofac Implants* 2003; 18: 848–55.
8. Moy PK, Medina D, Shetty V, Aghaloo TL. Dental implant failure rates and associated risk factors. *Int J Oral Maxillofac Implants* 2005; 20: 569–77.
9. Quirynen M, Vogels R, Alsaadi G, Naert I, Jacobs R, van Steenberghe D. Predisposing conditions for retrograde periimplantitis, and treatment suggestions. *Clin Oral Implants Res* 2005; 16: 599–608.
10. Albrektsson T, Zarb GA, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: a re- view and proposed criteria of success. *Int J Oral Maxillofac Implants* 1986; 1: 11e25
11. Smith DE, Zarb CA. Criteria for success of osseointegrated endosseous implants. *J Prosthet Dent* 1989; 62: 567–72.
12. Esposito M, Hirsch J-M, Lekholm U, Thomsen P. Biological factors contributing to failures of osseointegrated oral implants. (I) Success criteria and epidemiology. *Eur J Oral Sci* 1998; 106: 527–551.
13. Jung RE, Zembic A, Pjetursson BE, Zwahlen M, Thoma DS. Systematic review of the survival rate and the incidence of biological, technical, and aesthetic complications of single crowns on implants reported in longitudinal studies with a mean follow-up of 5 years. *Clin Oral Implants Res*. 2012;23(Suppl 6):2–21
14. Malathi G, Chandra R. Mechanical complications with implants. *IJDA*. 2011;3:555–8.
15. Schwarz MS. Mechanical complications of dental implants. *Clin Oral Implants Res*. 2000;11(Suppl 1):156–8.
16. Gupta S, Gupta H, Tandan A. Technical complications of implant-causes and management: A comprehensive review. *Natl J Maxillofac Surg*. 2015;6:3–8
17. Misch CE. Contemporary Implant Dentistry – 3rd Edition. Mosby, South Asia edition, 2008.
18. Prashanti E, Sajjan S, Reddy JM. Failures in implants. *Indian J Dent Res* 2011; 2: 446-453
19. Hobo S, Ichida E, Garcia LT. Osseointegration and occlusal rehabilitation. London UK: Quintessence Publishing Company; 1996. p. 239-54.
20. Goodacre CJ, Bernal G, Runghcharassaeng K, Kan JY. Clinical complications with implants and implant prostheses. *J Prosthet Dent*. 2003;90:121–32.
21. Pjetursson BE, Asgeirsson AG, Zwahlen M, Sailer I. Improvements in implant dentistry over the last decade: Comparison of survival and complication rates in older and newer publications. *Int J Oral Maxillofac Implants*. 2014;29(suppl):308–24.
22. Mericske-Stern R, Assal P, Mericske E, Bürgin W. Occlusal force and oral tactile sensibility measured in partially edentulous patients with ITI implants. *Int J Oral Maxillofac Implants*. 1995;10:345–53.
23. Gammage DD, Bowman AE, Meffert RM. Clinical management of failing dental implants: Four case reports. *J Oral Implantol*. 1989;15:124–31.
24. Tolman DE, Laney WR. Tissue-integrated prosthesis complications. *Int J Oral Maxillofac Implants*. 1992;7:477–84.
25. Sánchez-Pérez A, Moya-Villaescusa MJ, Jornet-García A, Gomez S. Etiology, risk factors and management of implant fractures. *Med Oral Patol Oral Cir Bucal*. 2010;15:e504–8.
26. Walia MS, Arora S, Luthra R, Walia PK. Removal of fractured dental implant screw using a new technique: A case report. *J Oral Implantol*. 2012;38:747–50.
27. Perez AS. Etiology, risk factors and management of implant fractures. *Med Oral Patol Oral Cir Bucal* 2010; 15(3):e504-508.
28. Mombelli A, Lang NP. The diagnosis and treatment of peri- implantitis. *Periodontol 2000* 1998; 17:63e76.
29. Bain C. Influences of smoking on the periodontium and dental implants. *Dent Update* 1997;24:328e330.
30. Mombelli A. Prevention and therapy of peri-implant infections. In: Lang NP, Karring T, Lindhe J, editors. *Proceedings of the 3rd European Workshop on Periodontology: implant dentistry*. Berlin: Quintessence; 1999. p. 281e303.