

Review Article

Dental Implant Complications and Failure: A Review

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Abstract: It is important for a clinician to have knowledge of the possible complications that are to arise due to implant therapy. This review article focuses on complications of implant due to systemic health conditions of the patient, followed by complications due to improper treatment planning and complications due to prosthetic components. It also throws light on the criteria for implant prognosis.

Keywords: Implant dentistry, Complications, patient.

INTRODUCTION

Implant dentistry has reduced the limitations of conventional prosthetic modalities. With the increased use of osseointegrated implants, it becomes important to predict the success and failure of implant prosthesis, or even so, manage failing implants the predictability of the complications that are to arise and its management is of great importance for the clinician [1].

Each of the complications has a risk factor present during the treatment planning stage. These risk factors include mechanical factors, anatomic factors, occlusal factors and host factors.

This article reviews various implant associated complications and their management. It is necessary for a clinician to be fully aware of the complications and risks of implant dentistry [2].

Implant failure [3]

According to Askary *et al.* failures of implants can be classified into:

1. Ailing implant: implants having soft tissue complications. These have a favourable prognosis.
2. Failing implant: the implant that progressively loses its bone anchorage, but is still clinically stable.
3. Failed implant: implants with excessive bone loss and clinical mobility which are not amenable.

Implant complications

Stuart J Froum in the year 2010 classified implant complications as: [4, 5]

1. Associated with systemic disorders and medications
2. Associated with implant planning
3. Implant fractures
4. Implant failures
5. Peri-implantitis
6. Aesthetic complications due to implant malposition

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7. Related to immediate implant placement
8. Related to immediate loading of implant
9. Those occurring during the first stage surgery, second stage surgery, abutment connection, prosthetic procedure, post prosthesis placement.

Systemic condition associated implant complications [4]

- A. Cardiovascular Disease and Stroke doesn't directly influence the success or failure of an implant but the management of these two is what the clinician should be concerned about. Continuous monitoring of blood pressure, stress levels and medicinal interactions should be carried out. Patients with previous history of valvular prosthesis are at a high risk of infection. Dental procedures extending more than 15 minutes have a higher risk to cause transient bacteraemia.
- B. Pharmacological considerations: bisphosphonates function as bone resorption inhibitors by depressing osteoclast function. Osteonecrosis of the jaws has been recently seen in a subset of patients receiving these drugs. Oral bisphosphonates have lower risk for osteonecrosis than i.v bisphosphonates.
- C. Diabetes has a negative impact on bone metabolism. It therefore impacts implant placement in the regions of cancellous bone [6].
- D. Smoking as well as nicotine products have various deleterious effects such as decreasing tissue perfusion, increasing platelet adhesion. Smoking affects healing after implant placement. Smoking increases the rate of complications [7].

Rate of Complications in the above mentioned systemic conditions can be reduced by taking a proper case history. In cases of history of valve replacement, a proper pre-operative course of antibiotics. In patients with habit of smoking and tobacco chewing, abstaining from habits should be advised.

Complications associated with implant treatment planning

Just like in case of conventional treatment modalities, implant dentistry may also result in complications ranging from minor (screw loosening, chipped porcelain, peri-gingival inflammation) to major such as implant failure, implant fracture, bone necrosis, etc.

Complication [6]

1. Improper location and angulation of implant
 2. Nerve injury
 3. Cortical plate perforation
 4. Sinus membrane complications
-
- A. Tooth or root proximity to the planned implant site should be evaluated as during implant placement adjacent tooth can be damaged.
 - B. Adjacent tooth should be evaluated for peri-apical lesions as the infection from the adjacent tooth can spread to implant leading to fenestration or dehiscence.
 - C. Another factor that plays a significant role is the proximity to vital anatomic structures such as inferior alveolar canal, sinus, mental foramen, etc. Anatomic variations can lead to perforations, nerve damage, insuring complications.
 - D. Evaluation of soft tissue, gingival biotype gives an idea of the bone resorption post extraction. Thin biotype shows more resorption after extractions. To avoid bone loss, bone grafts post extractions can be placed.
 - E. Inter-ach space and inter-implant space should be considered prior to implant placement. At-least 3mm space between two implants and 1.5mm space between implant and tooth should be present[8].
 - F. Anterior-posterior spread of implant: according to English, the cantilever spread should not extend 1.4 times the AP spread. Cantilevers lead to higher stresses and bending or torqueing movements. In such cases the number of implants should be increased as well as stiffer frameworks should be utilized.
 - G. Implant positioning: improper angulation of implant also leads to implant failures. Surgical guides help reduce the rate of complications in such cases.

Mechanical complications -implant fracture and fatigue

According to Misch, implant fracture occurs over a period of time due to implant fatigue cycles. Early implant fractures occur due to implant over-load which is most likely due to improper prosthesis.

Implant shape, implant diameter, implant design, abutment screw configuration, and patient/host factors influence implant fracture.

1. Implant diameter is of utmost importance for fracture resistance as the fracture resistance increases proportionally with increase in radius of implant to fourth of its power [9].

2. Implant fracture also results due to prosthetic misfit. When the casting is not adapted to abutment or to the implant.
3. Implant fractures happen when bone loss is beyond implant-abutment engagement. This happens as the area is most vulnerable to cyclic fatigue being the thinnest area of the implant.
4. Bone loss can also be secondary to microfracture of the alloy microstructure or can be a sequelae of fracture itself.
5. Patient related factors such as parafunctional activity leads to excessive force on the implant. In such cases, occlusal guard should be provided to the patient, more number of implants to distribute forces better, considering larger diameter implants, etc
6. Fractures due to overload: capacity of force generation in class II patients is less compared to class III.
7. In case of screw retained restorations: lateral forces can overcome clamping forces, resulting in screw loosening. This can be compensated by minimizing lateral forces by maximizing offset implants, flattening the occlusion, minimizing cantilevers, etc.
8. Implant-crown ratio is another factor that increases load transfer to implant.

BIOLOGICAL COMPLICATIONS

Peri-implantitis

This is a biologic complication of implant therapy, including peri-implant mucositis. Peri-implant mucositis resembles gingivitis in some aspect, shows symptoms such as swelling, redness and bleeding on probing. On the other hand peri-implantitis along with the symptoms of inflammation also includes peri-implant bone loss [8].

Meffert described it as “progressive loss of peri-implant bone as well as soft tissue inflammatory changes [10]”. The microbiota in peri-implant infections was found to be identical to those in advanced periodontitis.

Staphylococcus aureus is known to attach to almost any biofilm on titanium [11]. Peri-implantitis also leads to formation of intrabony defects around the implant resulting in saucer shaped configuration. This clinically is reflected as sudden increase in implant mobility [12].

Pus formation/ suppuration is a sign of active infection process. This is oftenly seen in peri-implantitis cases. Maintenance: plaque control becomes an integral part for prevention of infection. Recall at regular intervals to check the following- swelling, redness, bleeding on probing, mobility etc. debridement in cases where necessary and antibiotic therapy and resective or regenerative therapy where probing depth exceeds 5 mm.

Gingival inflammation and proliferation

Inflammation is noted around dental implants has been noted when the over-denture bars or the frameworks is placed too close to the tissue. This response is also seen in cases of loose or fractured screws which lead to bacterial accumulation.



Fig-1: showing gingival tissue proliferation around implants

Prosthetic complications

1. No passive fit: achieving passive fit of the prosthesis is considered an important factor for implant success. Absence of passive fit can be clinically seen as pain, discomforts, loosening or fracture of implant components in the long term. Factors that might impair passive fit are dimensional changes of the ceramometal restorations, improper spacer application and use of improper metal for casting. Metal try-in should always be performed, if not done in single implant cases, should be done without fail in long span [12].
2. Prosthesis fracture: this occurs because of increased forces. An opposing conventional denture may fracture as the occlusal forces are greater when implants are present on opposing arch.
3. Screw Loosening or fracture: while placement it should be taken care of that when the screw is tightened, it should only rotate about a quarter of a turn. Heavy occlusal loads or cantilevers also contribute to screw loosening [12, 13].

Occasionally, the abutment screw loosens, and there isn't an access to retighten the screw. For the same reason, clinicians use lingual retaining screws rather than cementation of crowns.

4. Excessive cantilever, improper fit of abutment, improper occlusal scheme, connecting implants to natural teeth, etc lead to greater amount of shear stress on the implant. Improper abutment fit leads to screw joint failure, either loosening or fracture of the screw [12].

Dental implant health scale [14]

Success(optimum health)	Satisfactory survival	Compromised survival	Failure
No pain/tenderness	No pain on function	May or maynot have sensitivity	Can have pain, mobility
No mobility	No mobility	No mobility	Mobility is seen
<2mm bone loss	2-4mm bone loss	>4mm radiographic bone loss	>1/2 length of implant length bone loss is seen
No exudates	No exudates	May have history of exudate	Uncontrolled exudate or implant no longer in mouth.

CONCLUSION

The success of implant is not just based on diagnosis and treatment planning but also on management and knowledge of complications arising. The most common complication being inflammation followed by prosthetic complications. A prompt and quick recognition of the problem and its management helps minimizing the complications. Ailing implant often shows progressive bone loss but no clinical pocket development. A failing implant shows similar features but continues to become worse with signs of inflammation and bleeding on probing .all of which require management and comprehensive therapy.

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