Failures in Dental Implants: A Review

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ABSTRACT

The primary reason to consider dental implants to replace missing teeth is to maintain the level of alveolar bone. The most common type of implant failures is caused either by poor treatment planning or poor surgical execution. To optimize the treatment outcome through dental implants, etiology and factors associated with implant failures should be taken into consideration. Such knowledge is needed for developing adequate treatment and prevention strategies. Hence, this review is intended to provide an insight regarding various aspects of failures that affect dental implants.

Keywords: Ailing and failing implants, Classification of implant failures, Implant failure, Peri-implantitis

INTRODUCTION

Dental implant survival depends on successful osseointegration following placement. Excessive surgical trauma, infection, or metabolic disorders may adversely affect treatment outcome by altering the biological process. As an implant is restored and placed in function, bone remodeling becomes a critical aspect of implant survival in response to the functional demands placed on the implant restoration and supporting bone.

Failures occasionally do occur, even though the success rate with implant therapy is high. A thorough knowledge regarding the various aspects of failure is deemed necessary for successful management.

PARAMETERS FOR THE EVALUATION OF IMPLANT FAILURE

Although it is probable to differentiate between a successful and a failed implant clearly, it still remains challenging to identify failing implants. Esposito et al. discussed the parameters, which have been employed clinically to evaluate implant conditions. The most common diagnostic criteria established for the implant failures (failed implants) are as follows.

Clinical Signs of Early Infection

Signs of infection which occur during the early stage of healing are more critical than if they occur at a later stage. Infection occurring at an early stage will lead to disturbance in the osseointegration of the implant to the surrounding bone. The most common complications seen are swelling, fistulas, suppuration, early/late mucosal dehiscences, and osteomyelitis during the healing period (3–9 months) which indicates implant failure.

Mombelli et al. compared clinical and microbiological finding related to healthy and failing dental implants. Futile implant sites were categorized by probing depths of 6 mm or greater in association with suppuration, bone loss, and microbiota consisting primarily of Gram-negative anaerobic rods.

Discomfort or Sensitivity

Pain or discomfort is the first sign which indicates an implant failure and is often associated with mobility.

Clinically Distinct Movement

Several different types of mobility have been recognized as: (1) Rotation mobility, (2) lateral or horizontal mobility, and (3) axial or vertical mobility. Sometimes, clinically apparent movement of the implant can be present minus distinct radiographic bone changes. Therefore, mobility is the cardinal sign of implant failure.

Radiographic Signs of Failure

There can be two well-distinct radiographic pictures in implant failure. First is a thin perifixtural radiolucency...
surrounding the entire implant. This suggests the absence of a direct bone-implant contact and possibly a loss of stability. Second being an increased marginal bone loss. When a suspected perifixtural radiolucency or excessive marginal bone loss is observed, it is recommended to remove the prosthetic construction and check the implants for stability. Clinically noticeable mobility after framework removal will endorse the reasonable radiographic identification of implant failure.\[4\]

**Dull Sound at Percussion**

A subdued sound on percussion is indicative of soft tissue encapsulation. A clear crystallization sound indicates successful osseointegration.\[1]\n
**Bleeding on Probing**

Bleeding on probing has been a measure of peri-implant tissue conditions. However, recent findings suggest that it cannot be used to discriminate between a healthy and diseased peri-implant state and it has no scientific evidence to support it.

El Askary et al.\[5\] in 1999 gave eight warning signs of implant failure which are (i) connecting screw loosening (ii) connecting screw fracture (iii) gingival bleeding and enlargement (iv) purulent exudates (v) pain (not very common) (vi) fracture of prosthetic component (vii) angular bone loss and (viii) long-standing infection and soft tissue sloughing.

Table 1 summarizes a description of implant failures, the problems encountered and the solutions to it.\[5\]

Rosenberg et al.\[14\] classified implant failures as an: (1) infectious failure and (2) traumatic failure.

An implant is determined to have failed from infection if one or more of the below-mentioned criteria are seen. They include clinical signs of infection with classic symptoms of inflammation, high plaque and gingival indices, pocketing, bleeding, suppuration, attachment loss, radiographic peri-implant radiolucency, and presence of glaucomatous tissue on removal. Implants are suspected to fail from traumatic conditions if the following conditions, i.e., radiographic peri-implant radiolucency, mobility, lack of glaucomatous tissue on removal, lack of increased probing depths and low plaque, and gingival indices exist.

Truhalar\[11\] classified failures as early and late failures. Early failures occur within weeks to few months after placement. They were caused by factors that can interfere with normal healing processes or by an altered healing response. Late failures were those that arose from pathologic processes that involved a previously osseointegrated implant.

Heydenrijik et al.\[15\] classified implant failures are referring to the occurrence in time as early failures, in which osseointegration had never been established, thus representing an interference with healing process.

Late failures are the one in which osseointegration was not maintained implying processes involves loss of osseointegration. Soon late failures referred to implants failing during the 1st year of loading and delayed late failures referred to implants failing in subsequent years.

**CONCLUSION**

Clinical trials document a consistently high success rates for endosseous dental implants in partially and
Table 1: (Continued)

<table>
<thead>
<tr>
<th>Classification of implant failure</th>
<th>Problems seen</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>F. Irradiation therapy:</td>
<td>Osteoradionecrosis is commonly seen. Endarteritis of vessels causes the decrease in oxygen supply to the tissues[8]</td>
<td>Hyperbaric oxygen therapy Waiting period of 6–12 months</td>
</tr>
<tr>
<td>G. Pregnancy:</td>
<td>Implant surgery procedures are contraindicated</td>
<td>Dental prophylactic appointments are suggested in 2nd and 3rd trimester</td>
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<td>2. Surgical placement:</td>
<td>Severe angulation</td>
<td>Graft the area to allow proper implant placement and use of angulated abutments</td>
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<td></td>
<td>Lack of initial stability</td>
<td>Proper drill grip, sharp drills should be used</td>
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<td></td>
<td>Impaired healing</td>
<td>Proper flap design, blood supply, visibility, access, and the primary closure</td>
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<td></td>
<td>Overheating the bone</td>
<td>A combination of copious irrigation system and sharp drills should be used to prevent it</td>
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<td>Minimal space between the implants</td>
<td>A space of 3–5 mm is necessary between implants to allow biologic space to avoid necrosis due to blood supply impairment</td>
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<td>3. Implant selection:</td>
<td>Improper implant length</td>
<td>Implant placement in an infected socket should be avoided. The waiting period of 2–6 months can prevent implant failure</td>
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<td></td>
<td>Number of implants</td>
<td>Long-term success of implant depends on bone-implant contact hence short implant will lead to higher stress concentration Use of more number of implants decreases the number of pontics and the associated mechanics and strains on the prosthesis. It dissipates stresses more effectively to the bone structure</td>
</tr>
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<td>4. Restorative problems:</td>
<td>Screw loosening</td>
<td>Framework should have greater dimension occluso gingivally</td>
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<td>Excessive cantilever</td>
<td>Oclusal forces should be shared evenly by all implants Flathead screw design</td>
</tr>
<tr>
<td></td>
<td>No passive fit</td>
<td>A mesial cantilever is favored</td>
</tr>
<tr>
<td></td>
<td>Improper fit of the abutment</td>
<td>Laboratory technique should minimize casting shrinkage and inaccuracies. A non-passive framework try-in technique will achieve a stable and passive fit</td>
</tr>
<tr>
<td></td>
<td>Bending moments</td>
<td>Fit of the components must be checked before taking the impression Avoid connecting the implant and natural tooth to prevent an intrusion of a natural abutment</td>
</tr>
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<td>Connecting implants to natural teeth</td>
<td>Medical history, dental history, radiographs, CT, models[9] Nerves (&lt;1 mm from implant), vessels, adjacent teeth (&lt;.5 mm from implant), type IV bone and sinus/nasal floor[9] Drilling torque, proper irrigation, correct armamentarium, surgical guide[9]</td>
</tr>
</tbody>
</table>

II. According to timing of implant failure UCLA team (Beumer. Moy)

| 1. Complications in Stage I surgery: | Damage to mental nerve Penetration into a maxillary air sinus, nasal cavity, or through inferior border of the mandible Excess countersink Thread exposure Eccentric drills, taps Stripping of threads Jaw fracture Ecchymosis, more common in older patients Wound dehiscence Facial space abscess, sub-mental, sub-mandibular abscess, Ludwig’s angina Suture abscess Loss of cover screw[9] |

(Contd...)
Classification of implant failure

Problems seen

2. Complications in Stage II surgery:
   - Poor selection of fixture height
   - Incorrect fixture placement, more than 35° cannot be used prosthetically
   - Damaged hex nut on top of fixture
   - Loss of abutment
   - Fractured abutment screw
   - Early loading by prostheses
   - Poor air-flow pattern with “high water” design
   - Aspiration of instruments
   - Thread exposure
   - Fixture fractures
   - Excess bone resorption
   - Plaque/calculus formation
   - Periodontal problems
   - Poor selection of abutment height

3. Prosthetic complications:
   - Insufficient space beneath the fully bone anchored prosthesis
   - Abutments penetrate through alveolar mucosa (unattached tissue)
   - Screw fractures: Gold or abutment screws
   - Acrylic or porcelain fracture
   - Posterior fixation failures in the maxilla

Solution

Achieve anchorage, primary stability
Analyze compromised situation dehiscence, fenestration, improper positioning/angulation
Accommodate problem by bone grafting, membranes, sutures, back-up implant, shorter implants, root canal therapy

Thorough knowledge about type of prosthesis
Post-operative instructions

1. Peri-implantitis

2. Retrograde peri-implantitis

1. Ailing implant

2. Failing implant

3. Failed implant

1. Lack of osseointegration

2. Unacceptable aesthetics

3. Functional problems

4. Psychological factors

1. Biological:
   - Early loading-failure to establish osseointegration
   - Delayed loading-failure to maintain the achieved osseointegration

2. Mechanical:
   - Component fracture, connecting screw fracture, prosthesis fracture, functional speech problems, malpositioned fixtures, etc.

3. Iatrogenic:
   - Nerve damage, hemorrhage, etc.

CT: Computed tomography

completely edentulous patients. Failures occur at a low rate but tend to cluster in those with common profiles or risk factors. In this paper, an attempt has been made to categorize the implant failures as related to implant devices, procedures, anatomy, systemic health or exposures, occlusion, microbial biofilm, host
immunoinflammatory responses, and genetics. In general, factors related to patient appear to be more critical than those related to the implant in determining the likelihood of implant failure.

REFERENCES


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