IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 23, Issue 9 Ser. 4 (September. 2024), PP 01-05
www.iosrjournals.org

Failures In Implantology: A Review Article

Dr Riya Sabu[1], Dr Merin Basil[1], Dr Girish Harikumar[1], Dr Aby Mathew T[2], Dr Rene Kuriakose[3]

[1](PG Resident,Deparment Of Prosthodontics And Crown And Bridge, Pushpagiri College Of Dental Sciences.Thiruvalla)

[2](Professor And Head, Department Of Prosthodontics And Crown And Bridge, Pushpagiri College Of Dental Sciences,Thiruvalla)

[3](Reader, Department Of Prosthodontics And Crown And Bridge, Pushpagiri College Of Dental Sciences,Thiruvalla)

Abstract:
Artificial intelligence and dental technology are combining, as the globe gets more technologically advanced. Implants have advanced from a stage of wishful thinking to one of the most rewarding experiences for patients and treating fraternity alike for the rehabilitation and retention of dental and facial prosthesis. The long-term survival rate of implants and the restorations they support is quite high. But there are complications associated with implant treatment. Due to the complexity of biological processes, local or systemic factors may impede them, potentially leading to issues and implant failure. It is critical for implant surgeons and other dental professionals to manage patients who have specific risk factors and to be prepared to handle problems and failure. The aim of this article is to discuss frequent complications of implant failure and its management and help clinicians in placing and restoring implants.

Keywords: *Implant failures, implant survival*

Date of Submission: 01-09-2024 Date of Acceptance: 11-09-2024

I. Introduction

Dental implant is one of the most popular treatment options for the restoration of missing teeth and associated structures. Advancements in the field of science and technology, with the aid of artificial intelligence made a drastic change in the field of implantology. Today implant prosthodontics are being successfully treated by general dentists and specialists. Thus, every effort should be made to minimise implant failures.[1]

The literature describes oral implant failures far less frequently reported than surviving and successful cases. Implants perform exceptionally well when implanted by qualified personnel using approved oral implant systems, which could be one explanation for this. Since implant academics write the vast majority of published papers, it follows that failures are rare and usually fall into the range of less than 5% over the course of a decade with contemporary, well-documented implants. Failures are reported far less frequently than successful cases for another reason that we have an innate need to stay optimistic. In fact, if the conversation is about faulty implants, no clinic is really encouraged.[2]

Gaining more insight into the causes of implant failure can help plan future research, making therapeutic decisions easier, and potentially increase the implant success. Once the hazards have been recognised, implant failures can be minimised or a different strategy can be used for the success of implant-based oral rehabilitation.[2]

II. Parameters Used For Evaluating Failed/Failing Implants

The distinction between a successful and a failed implant can be made with clarity, failing implants are still challenging to diagnose. The parameters which have been employed clinically to evaluate implant conditions were discussed by Esposito et al[7], with the attempt to identify the most reliable ones. The ideal parameter for monitoring implant conditions should be sensitive enough to distinguish early signs of implant failure. Following parameters have been proposed.[1]

Infections

Implant failure may result from a developing marginal infection. On the other hand, intervention is necessary when there are indications of infection that are not easily detected, including hyperplastic soft tissues, spontaneous suppuration, fistulation, colour changes in the surrounding peri-implant tissues, etc. These

symptoms point more towards a problem that is treatable than a failure when mobility and radiographic abnormalities are absent. [3]

Probing depth

For an endosteal implant, increasing probing depths over time may suggest bone loss, but do not always signify illness. If there is inflammation or exudate, sulcus depths larger than 5 to 6 mm around implants are more likely to harbour anaerobic bacteria and they need to be treated either with surgery or antibiotic treatments. Probing exposes tissue consistency, haemorrhage, and the presence of exudates in addition to measuring pocket depth[3]**.**

Pain or sensitivity

After healing, there should not be any pain. When it does occur, pressure on the soft tissue from the prosthesis or an ill-fitting prosthetic component are the most common causes. Clinical tests including percussion and forces up to 500gm (1.2 psi) can be used to assess implant pain and discomfort. An implant is classified as failing if its body experiences pain while functioning. This is a subjective criterion.[3]

Clinical discernible mobility

Failure is always evident when there is mobility. The implant must be suspected of having a fibrous tissue capsule surrounding it once the doctor has made the distinction between the mobility of the underlying implant and the movement of an abutment with inadequate connection. On rare occasions, there may be clinically discernible movement without any radiographic alterations to the bone. Mobility is thus the primary indicator of implant failure.[3]

Radiographic signs of failure

It is advised to remove the prosthetic construction and check the implants for stability if there is suspected peri-fixtural radiolucency or severe marginal bone loss.[3]

Dull sound at percussion

Despite being a test without any strong scientific foundation it might give the examiner helpful information According to theories, a subdued sound made upon percussion represents soft tissue encapsulation, while a clear crystallisation sound signifies effective osseointegration.[3]

III. Risk Factors Associated With Dental Implants

Dentist Related

Pre-Operative Factors

- Severe angulations
- Lack of initial stabilization
- Impaired healing
- Overheating the bone
- Minimal space between the implants
- Placing implant in immature bone
- Placement in infected socket

Post Operative Factors

- Improper design and guidance of the crown
- Too high a cusp or too high occlusal alignment
- Occlusal forces contribute to implant fractures and peri-implant bone fractures. Crown width, cusp height, guidance, and occlusal alignment can all be used to control occlusal forces.[4]

Implant Related Risk Factors

The majority of dental implant materials now utilised in clinics are highly biocompatible with human tissues. Titanium, Cobalt-Chromium Molybdenum, Titanium-Aluminum Vanadium (Ti-6Al-4V), and, less frequently, other alloys are used to make them. [5,6] Over the past 50 years, dental implant materials have seen remarkable improvement to satisfy a variety of needs. To avoid implant failures and increase the lifespan of implants in use, additional research and development is necessary to provide effective and biocompatible materials.[7,8]

Host Related Risk Factors

It can be local or systemic

Local Risk Factors

Bone quality and Bone quantity

The patients most at risk of losing their implants were those with low bone density and quantity. In their 5-year investigation, Jaffin and Berman[9] found that type IV bone, with its thin cortical, low trabecular density, and poor medullary strength, accounted for up to 35% of all implant failures. Local bone density appeared to be more important than systemic bone density in the Dao et al. investigation. [10]

Irradiated bone

Implants can be used to provide anchorage for craniofacial prostheses. Radiotherapy in combination with surgical excision is the treatment generally employed for malignant tumors in that region, and osteoradionecrosis is one of the oral effects of radiation therapy. Although radiation therapy is not an absolute contraindication to implant treatment, the reported success rate is only about 70%.

Biomedical occlusal loading

Occlusal loading beyond physiological limits can strain the hard peri implant bone because implants lack the protective periodontal ligament system. Due to non-optimal load protection and force absorbing and distributing systems, a dental implant is subjected to implant micromotion ranging from 50 to 150 micrometers. [12,13]

Smoking

Bain and Moy suggested that smoking caused both systemic and local injury to the tissues and is a common contributor to decrease tissue oxygenation, which negatively affects wound healing.[14]Studies suggest smoking as the factor associated with complications like marginal bone loss, peri-implantitis, bone quality, and quantity, which in turn affect the implant success rate. In fact, success rate of dental implant is found to be twice in nonsmokers as compared to smokers and that too maxillary implant is more affected.[14]

Parafunctional habits

Patients with parafunctional habit experience metal fatigue and implant fractures more frequently than others[15]. More than 77% of all implant fractures have been reported to occur in patients who have signs and a history of chronic bruxism. Increased peri-implant bone loss is also linked to para-functional habits. [17]

Systemic Risk Factors

Diabetes mellitus

Uncontrolled Diabetes is associated with a wide range of systemic complications including microvascular and macrovascular diseases, altered wound healing, and increased susceptibility to infection. These conditions may increase the risk of postsurgical complications following dental implant placement. Uncontolled diabetes negatively impacts bone metabolism, with decreased osteoblast differentiation and proliferation, decreased collagen production, and increased osteoblast apoptosis.

Osteoporosis

The main pathological features of osteoporosis are low bone mass and a micro architectural deterioration of bone leading to fragility, and then to an increased fracture risk. Both the maxilla and mandible can be affected by osteoporosis, which has been considered a risk factor for implant failures and periodontal diseases.

Medication and Irradiation

Some medications widely used in clinics cause bone loss. In particular, glucocorticosteroids cause iatrogenic osteoporosis by increasing bone resorption via stimulation of osteoclastogenesis. Other drugs with deleterious effects on bone include chemotherapeutic agents, such as doxorubicin and methotrexate which inhibit osteoblasts and diminish bone formation.

IV. Etiology Of Implant Failure

Local Causes

- INFECTION
  - PERI IMPLANTITIS
  - FISTULATIONS

- MUCOSAL ABSCESSES
- HYPERPLASTIC MUCOSITIS

➢ IMPLANT FRACTURES
➢ IMPLANT MALPOSITIONS

Systemic Causes

➢ DIABETES
➢ MYOCARDIAL INFECTION
➢ OSTEOPOROSIS
➢ CORTICOSTERIODS
➢ BISPHOSHONATES

V. Management Of Implant Failures

Local causes management

Peri-implantitis

There are a few things to keep in mind when handling cases of peri-implantitis. Patients should receive extensive instruction on good oral hygiene practices, with a focus on cleaning the areas around implants. Periodontal maintenance should be administered at least once a year, depending on the patient's history and risk of developing the disease [19]. Note that peri-implant infections are more common in those with a history of periodontitis. If bleeding or mucositis is observed close to the implant, take prophylactic measures. [20] Anaerobic bacteria inhabit these ecological niches, and lesions should be probed down to a depth of 6 mm. A radiograph should be taken if the probing depth around an implant is 6 mm or greater.[21]

Implant fracture

Fractured implants should be removed using trephines and new implants can be placed at the same time. Apicoectomy is useful procedure for removing fractured implants and placing new implants at the same time.[22]Treatment planning for a patient with partial dentition must take the anticipated implants' length and diameter into consideration. Risk reduction may require more implants in order to build the prosthesis adequately and prevent fracture. It is recommended that all patients who exhibit parafunctional tendencies wear occlusal guards. Cantilevers and other unsupported prosthetic extensions are to be avoided in the molar regions if at all feasible. Watch for signs of significant bone loss and frequent screw-loosening.

Esthetic complications and management of Implant malpositions

Make sure the patient is aware of risks and repercussions of the surgery . Preexisting hard and soft tissue abnormalities sometimes make achieving ideal aesthetic results impossible. It is important to measure the hard and soft tissues of the site precisely in relation to the proposed implant position. The facial bone's thickness should remain at 2 mm [23]. Ensure that the implant is positioned in the proper 3D location as defined by the restoration. The implant should be positioned in the apico-coronal plane about 2-3mm apical to the predicted mucosal boundary of the implant restoration , mesiodistal plane is at least 1.5 mm away from the roots of adjacent teeth, and orofacial plane is at the level of the gingival edge and 1.5 mm orally to the facial curve of the arch. If it is anticipated that it would be challenging to position the implant appropriately, a surgical guide stent should be taken into consideration. In cases where there are numerous lost teeth, surgical stents are strongly advised.[24]

Systemic Causes Management

Diabetes

Two essential components of surgical management for any patient with diabetes are limiting surgical therapy in poorly controlled diabetic patients and having a thorough awareness of the patient's medical history, current course of treatment, and degree of glycemic control throughout time. The way diabetes mellitus is managed medically has changed significantly during the past ten to fifteen years [25]. Individuals who do not maintain optimum glycemic control may be more susceptible to surgical problems including wound infection or delayed healing. In order to prevent such unfortunate events, the dental clinician needs to ascertain how well or poorly the patient is controlled by asking about their history, including past HbA1c readings.[26] Postoperative surgical problems are most likely to affect diabetics with the lowest glycemic control. Prior to implant surgery, it is preferable to have optimal glycemic control.

Osteoporosis

A current medical history should be gathered before implant surgery. Individuals who are at risk of developing metabolic bone disease should have their nutrition examined, undergo rigorous screening, and have any underlying issues addressed before moving on. [27] Physiologic calcium (1,500 mg/day) and vitamin D (400-800IU/day) dosages are advised throughout the postoperative period. Patients should make an effort to

discontinue smoking and adhere to a balanced preoperative and postoperative diet, as smoking is a substantial risk factor for osteoporosis and implant failure[28].

Myocardial Infection

Preventive strategies include nitrate premedication, oxygen delivery, achieving profound local anaesthesia, stress management techniques, preoperative pain medication, and patient monitoring of blood pressure and heart rate[30]. Furthermore, the use of conscious sedation may aid in maintaining the patient's comfort and relaxation. Additionally, the dental professional needs to understand that receiving oral implants does not always mean that thrombolytic or anticoagulant medications must terminate.[31]

Corticosteroids

Patients receiving corticosteroid medication might not be a good risk category for implants, even in the absence of proof to the contrary. First and foremost, consult a physician. Medicolegal and other reasons suggest that, even while the veracity of the evidence supporting the use of steroids may be questioned, it is best to follow the side of caution and provide steroids only after one is assured that collapse is highly unlikely.

Bisphosphonates

Prior to receiving intravenous bisphosphonate therapy, a patient needs to have dental stability and a thorough oral examination. Any remaining infection needs to be eradicated.

If any problem requires oral surgery, including implant insertion, healing must be completed before intravenous bisphosphonates are administered.[32] In order to prevent dental disorders that could require dentoalveolar surgery, patients receiving intravenous bisphosphonates for asymptomatic diseases should maintain good oral hygiene and receive regular dental care. Procedures that cause direct osseous injury should be avoided. Oncology patients who have undergone multiple doses of the stronger intravenous treatment (4–12 times year) should not have dental implants placed.[33] While using oral bisphosphonates, surgery is not forbidden; nevertheless, the dentist must proceed cautiously and inform the patient of any possible adverse effects.

VI. Conclusion

Given the prevalence of implant use and its projected growth in the coming years, it is expected that dentists will have to deal with implant failure and its aftereffects more frequently. To cure the existing ailment and acquire knowledge for future therapies, the cause must be found. Routine checkups always allow for timely action. It takes education, training, and experience to minimise the quantity and severity of problems that will inevitably develop. Sadly, it is often the case that the lesson arrives after the final examination, which is why using experience as a guide presents a challenge.

REFERENCES

[1] . Sheldon Winkler, DDS. Extraordinary Implant Failure. Journal of Oral Implantology. DOI: 10.1563/AAID-JOI-D-09-00088. Vol. XXXVI/No. Five/2010

[2]. Bruno Chrcanovic. On Failure of Oral Implants. Malmö University, Faculty of Odontology Doctoral Dissertations 2017

[3]. Esposito M, Hirsch JM, Lekholm U, Thomsen P. Biological factors contributing to failures of osseointegrated oral implants. II. Etiopathogenesis. Eur J Oral Sci. 1998; 106(3):721-764.

[4]. Ericsson I, Nilner K. Early functional loading using Brane- mark dental implants. Int J Periodontics Restorative Dent. 2002; 22(1):9-19.

[5]. Santavirta S, Nordstrom D, Ylinen P, Konttinen YT, Silvennoinen T, Rokkanen P. Biocompatibility of hydroxy- apatite-coated hip prostheses. Arch Orthop Trauma Surg. 1991; 110(6):288-292

[6]. Aspenberg P, Anttila A, Konttinen YT, Lappalainen R, Goodman SB, Nordsletten L et al. Benign response to particles of diamond and SiC: bone chamber studies of new joint replacement coating materials in rabbits. Biomaterials. 1996; 17(8):807-812

[7]. Lacefield WR. Hydroxyapatite coatings. Ann N Y AcadSci. 1988; 523:72-80.

[8]. Lumbikanonda N, Sammons R. Bone cell attachment to dental implants of different surface characteristics. Int J Oral Maxillofac Implants. 2001; 16(5):627-636

[9].Salama H, Salama MA, Li TF, Garber DA, Adar P. Treatment planning 2000: an esthetically oriented revision of the original implant protocol. J Esthet Dent. 1997; 9(2):55-67.

[10]. Garber DA. The esthetic dental implant: letting restoration be the guide. J Am Dent Assoc. 1996; 22(1):45-50.

[11]. Jaffin RA, Berman CL. The excessive loss of Branemark fixtures in type IV bone: a 5-year analysis. J Periodontol. 1991; 62(1):2-4.

[12]. Dao TT, Anderson JD, Zarb GA. Is osteoporosis a risk factor for osseointegration of dental implants? Int J Oral Maxillofac Implants. 1993; 8(2):137-144

[13]. Jacobsson M, Tjellstrom A, Thomsen P, Albrektsson T, Turesson I. Integration of titanium implants in irradiated bone. Histologic and clinical study. Ann OtolRhinolLaryn- gol. 1988; 97:377-340

[14]. Bain CA, Moy PK. The association between the failure of dental implants and cigarette smoking. Int J Oral maxillofacial Implants. 1993; 8(6):6

[15]. Balshe AA, Eckert SE, Koka S, Assad DA, Weaver AL. The effects of smoking on the survival of smooth-.androughsurface dental implants. Int J Oral Maxillofacial Implants. 2008; 23(6):1117-1122

[16]. Bain CA. Smoking and implant failure-benefits of a smoking cessation protocol. Int J Oral Maxillofac Implants. 1996; 11(6):756-759

[17]. Wahlström M, Sagulin GB, Jansson LE. Clinical follow-up of unilateral, fixed dental prosthesis on maxillary implants. Clin Oral Implants Res. 2010; 21(11):1294-1300.

[18]. Kochar S P, Reche A, Paul P (October 19, 2022) The Etiology and Management of Dental Implant Failure: A Review. Cureus 14(10): e30455. DOI 10.7759/cureus.30455

[19**].** Chan HL, Lin GH, Suarez F, MacEachern M, Wang HL: Surgical management of peri-implantitis: a systematic review and meta-analysis of treatment outcomes. J Periodontol. 2014, 85:1027-41. 10.1902/jop.2013.13056

[20]. Heitz-Mayfield LJ, Mombelli A: The therapy of peri-implantitis: a systematic review . Int J Oral Maxillofac Implants. 2014, 29:325-45. 10.11607/jomi.2014suppl.g5.3

[21]. Mombelli A, Müller N, Cionca N: The epidemiology of peri-implantitis . Clin Oral Implants Res. 2012, 23:67- 76. 10.1111/j.1600-0501.2012.02541.x[22] Stacchi C, Chen ST, Raghoebar GM, et al.: Malpositioned osseointegrated implants relocated with segmental osteotomies: a retrospective analysis of a multicenter case series with a 1- to 15-year follow-up. Clin Implant Dent Relat Res. 2013, 15:836-46. 10.1111/j.1708-8208.2012.00444.x

[23]. Bousquet P, Barthélemi S, Artz C, Delsol L: The application of orthodontic bone stretching for correcting malpositioned dental implants. Head Face Med. 2021, 17:42. 10.1186/s13005-021-00294-y

[24]. Stefanini M, Felice P, Mazzotti C, Mounssif I, Marzadori M, Zucchelli G: Esthetic evaluation and patientcentered outcomes in single-tooth implant rehabilitation in the esthetic area. Periodontol 2000. 2018, 77:150-64. 10.1111/prd.12215

[25]. Mealey BL, Oates TW: Diabetes mellitus and periodontal diseases . J Periodontol. 2006, 77:1289-303. 10.1902/jop.2006.050459

[26]. Mealey BL: Management of the patient with diabetes mellitus in the dental office . Diabetes mellitus and oral health: an interprofessional approach. Lamster IB (ed): Wiley-Blackwell, Ames, IA; 2014. 99-120

[27]. Cooper LF: Systemic effectors of alveolar bone mass and implications in dental therapy . Periodontol 2000. 2000, 23:103-9. 10.1034/j.1600-0757.2000.2230110.x

[28]. De Bruyn H, Collaert B: The effect of smoking on early implant failure . Clin Oral Implants Res. 1994, 5:260- 4. 10.1034/j.1600-0501.1994.050410.x

[29]. Vandone AM, Donadio M, Mozzati M, et al.: Impact of dental care in the prevention of bisphosphonateassociated osteonecrosis of the jaw: a single-center clinical experience. Ann Oncol. 2012, 23:193-200. 10.1093/annonc/mdr039

[30]. Roberts HW, Mitnitsky EF: Cardiac risk stratification for postmyocardial infarction dental patients . Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2001, 91:676-81. 10.1067/moe.2001.114827

[31]. Niwa H, Sato Y, Matsuura H: Safety of dental treatment in patients with previously diagnosed acute myocardial infarction or unstable angina pectoris. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2000, 89:35-41. 10.1016/s1079-2104(00)80011-6

[32]. Nase JB, Suzuki JB: Osteonecrosis of the jaw and oral bisphosphonate treatment . J Am Dent Assoc. 2006, 137:1115-9. 10.14219/jada.archive.2006.0350

[33]. Beauchamp J, Caufield PW, Crall JJ, et al.: Evidence-based clinical recommendations for the use of pit-andfissure sealants: a report of the American Dental Association Council on Scientific Affairs. J Am Dent Assoc. 2008, 139:257-68. 10.14219/jada.archive.2008.0155