

Dental Implant Maintenance – Key to Long Term Success

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Abstract

The use of dental implants has proven to be revolutionary in the field of dentistry for treatment of full or partial edentulism. Even though implant success is predictable with high success rate, implants are susceptible to diseases that may eventually lead to loss of implant. Most implant failures are initiated by early stages of inflammation, which further culminates to peri-mucositis and Peri-Implantitis. As many patients are preferring implants now, it is imperative to know the difference between maintaining natural teeth and implants. Implants and associated prostheses are different from natural teeth and may require adjunctive procedures and instruments for professional and patient care. The evidence regarding the value of maintenance protocol regarding implants is scarce as compared to teeth. This article reviews the existing literature on implant maintenance and post implant care.

Keywords: Implant, Dental Implant, Maintenance, Implant Care, Periimplantitis, Peri Implant Mucositis, Implant Maintenance, Professional Care

Introduction

Dental implant placement requires interdisciplinary approach which includes periodontist, prosthodontist, oral radiologist to evaluate, plan, execute and maintain the implants in the long run.¹Dental implants may suffer from various complications which includes biologic, surgical, prosthetic or aesthetic. Some complications can be minor and easily manageable but some are major and challenging to resolve. The serious complications can lead to loss of implant along with supporting bone.² Successful implants are result of effective home care by the patient as well as professional care in the dental office by the team of dentists. Hence, the role of dentist and patient goes hand in hand and their contribution is indispensable, especially for the long-term success of dental implants.³ Implant maintenance therapy focusses on regular follow up and monitoring the patient thus minimizing implant complications, preventing recurrence of any complications and identifying and treating the implant complications at initial stage⁴ A study by Costa et al proves the importance of implant maintenance programs in which 80 partially edentulous patients

restored with implants and diagnosed with peri-implant mucositis were monitored to check how often they progressed to peri-implantitis over 5 years. Patients active in a maintenance program progressed to peri-implantitis were (18%) compared with those not active in a maintenance program (43.9%).⁵ The complications of dental implant also depend on the frequency and type of maintenance program. Effective periodic follow up with simple periodontal probe can assess the distance between the soft tissue margin and a reference point on the implant, probing depth, the bleeding tendency, and suppuration.⁶ As the use of implants and implant supported prosthesis is increasing, it is imperative we brace up ourselves with the current update and guidelines for dental implant maintenance.

Discussion

A) Complications of implant:

Implant complications can be divided into

a. Surgical complications:

Surgical complications are those that result from surgery, which includes procedures such as implant site development, implant placement, implant exposure, and tissue augmentation. Surgical complications include malpositioned implants, soft tissue dehiscence, bone dehiscence, nerve impingement, anatomic impingement and implant failure.²

One of the simplest surgical complication can be hemorrhage and hematoma which can be effectively managed by applying pressure or suturing the hemorrhaging vessel. Bruising and small hematomas typically resolve without special treatment or consequence.

b. Biologic complications:

Biologic complications are the ones affecting hard and soft tissues that support the implant. Peri-implant tissue changes can be limited to inflammation of surrounding

soft tissues or be more significant, such as progressive loss of supporting bone. The ultimate biologic complication is implant loss or failure, which can produce soft and hard tissue defects.²

c. Mechanical complications:

Prosthetic/mechanical complications include screw loosening or fracture, implant fracture or fracture of restorative materials. The prosthesis can be rescued from many mechanical problems if they are minor and recognized early. However, some complications, such as implant fractures cannot be repaired. Prosthetic or mechanical complications occur when the strength of materials is no longer able to resist the forces that are being applied. As materials fatigue, they begin to stretch and bend. Ultimately, depending on the applied forces, they will fracture.²

d. Aesthetic and phonetic complications:

When the implant prosthesis doesn't meet patient's expectations, esthetic complications arise. They can arise due to poor implant position, color mismatch in prosthetics and other related factors. Phonetic problems can be created due to fabrication of implant prostheses with unusual palatal contours or that have spaces under and around the superstructure.²

B) Peri implant health, peri implant mucositis and periimplantitis

Peri implant tissues are divided into hard and soft tissue components- peri implant mucosa and peri implant bone⁷

According to current consensus

The diagnosis of peri-implant health requires:

1. Visual inspection demonstrating the absence of peri implant signs of inflammation: pink as opposed to red, no swelling as opposed to swollen tissues, firm as opposed to soft tissue consistency
2. Lack of profuse (line or drop) bleeding on probing

3. Probing pocket depths could differ depending on the height of the soft tissue at the implant location. An increase in probing depth over time, however, conflicts with per implant health; and
4. Absence of further bone loss following initial healing, which should not be ≥ 2 mm.⁸

The diagnosis of peri-implant mucositis requires:

1. Visual inspection demonstrating the presence of peri implant signs of inflammation: red as opposed to pink, swollen tissues as opposed to no swelling, soft as opposed to firm tissue consistency;
2. Presence of profuse (line or drop) bleeding and/or suppuration on probing;
3. An increase in probing depths compared to baseline; and
4. Absence of bone loss beyond crestal bone level changes resulting from the initial remodeling.⁸

The diagnosis of peri-implantitis requires:

1. Evidence of visual inflammatory changes in the peri implant soft tissues combined with bleeding on probing and/or suppuration;
2. Increasing probing pocket depths as compared to measurements obtained at placement of the supra-structure; and
3. Progressive bone loss in relation to the radiographic bone level assessment at 1 year following the delivery of the implant-supported prosthetics reconstruction; and
4. In the absence of initial radiographs and probing depths, radiographic evidence of bone level ≥ 3 mm and/or probing depths ≥ 6 mm in conjunction with profuse bleeding represents peri-implantitis.⁸

C) Maintenance of implants

Implants and associated prostheses are different from natural teeth and may require adjunctive procedures and instruments for professional and patient care. Instruments

must be effective at removing biofilms and tooth deposits and any procedure should avoid damage to any component of the implant, abutment, restoration, and tissues. Success of implant is increased if there is perfect soft tissue seal around the trans mucosal portion of the implant. This barrier is fundamentally a result of appropriate wound healing and connection of epithelial attachments. When peri implant tissues remain healthy, the success of implant is guaranteed. Also, tissues free of inflammation and a biofilm-free implant sulcus will support the patient's general and oral health.⁹

Criteria for implant success

The criteria for success in implant dentistry remain complex.

A) Albrektsson criteria for implant success (1986):

1. Individual unattached implant that is immobile when tested clinically.
2. Radiography that does not demonstrate evidence of peri-implant radiolucency.
3. Bone loss that is less than 0.2 mm annually after the implant's first year of service
4. No persistent pain, discomfort or infection

By these criteria, a success rate of 85% at the end of a 5-year observation period and 80% at the end of a 10-year period are minimum levels for success.¹⁰

Types of maintenance

There are four types of maintenance protocols and stages:

a. *Preventive maintenance*: As the name suggests this protocol starts right after implant is placed and prevents inception of any peri implant pathology

E.g. for this includes patients with systemic diseases, patients with poor dexterity and patients who can't maintain good oral hygiene

b. *Trial maintenance*: This maintains borderline conditions and observes for progression.

E.g. includes borderline pocket or furcation defects, defects in anatomy of gingiva.

c. *Compromise maintenance*: Type of maintenance in a patient who is not ideal candidate for surgery because of health, economics, inadequate oral hygiene or other considerations but would benefit from corrective treatment.

E.g. includes patients with undergoing chemotherapy, moderate periodontitis patient.

d. *Post treatment maintenance*: Prevents recurrence of disease after any corrective therapy.

E.g. includes periimplantitis patient who has been successfully treated with regenerative therapy.¹¹

In first year after implant therapy, patient should be followed up on frequent recalls. They should be assessed every 3 months. After a year, recall schedule depends on the individual needs. These factors include stability of the implant tissues, periodontal health of the surrounding teeth, systemic health, and the effectiveness of home-care procedures.¹²

Maintenance visits include evaluation of peri implant tissues, evaluation of prosthesis, removal of local deposits, reinforcement of oral hygiene protocols and radiographs when indicated. In the first year of treatment, radiographs of the implant should be taken at each three-month visit. After that, an annual radiograph should be taken and compared to the baseline radiograph. Because of surgical trauma, it is reasonable to expect 1.5 mm of bone loss in the first year and 0.2 mm each year thereafter. Excessive bone loss must be addressed immediately.¹²

Assessment of mobility of implant should be done at each follow up appointment. If there is mobility of implant prosthesis it can be repaired immediately. If there is mobility of implant fixture, it implies loss of osseointegration. The evaluation of the health of the peri-

implant tissue should include clinical inspection for signs of inflammation. The dental practitioner should also note the nature of deposits on the implant abutment. The presence or absence of debris, plaque, and supragingival or sub gingival calculus should be noted and further quantified as light, moderate, or heavy. Removal of deposits should be accomplished only with instruments that are incapable of damaging the implant surface.¹²

Implant maintenance procedures:

1. Educate and motivate
2. At home implant care
 - a) Post-surgical home care.
 - b) Brushing:
 1. Soft manual toothbrush
 2. Motorized tooth brush/power brush
 3. Automated/sonic tooth brush
 4. End-tufted brush
 5. Tapered rotary brush
 - c) Interproximal/ circumferential cleaning:
 1. Floss
 - Plastic floss
 - Braided flossing card
 - Satin floss
 - Woven floss
 - Yarns dental tapes
 2. Interproximal cleaners
 - i. Foam tips
 - ii. Interproximal brushes with a plastic-coated wire
 - iii. Disposable wooden picks
 - d) Locally applied chemotherapeutics:
Chlorhexidine, Fluoride-Containing Mouth Rinses, Essential Oils Mouth Rinse, Triclosan/Copolymer Toothpaste
 - e) Water irrigation
Hydrofloss

3. Professional hygiene care:

a) Scaling and curettage:

- Plastic instruments
- Plastic instruments reinforced with graphite
- Gold-plated curettes
- Ultrasonic or sonic scaler covered with a plastic sleeve

b) Polishing:

- Rubber cup with a nonabrasive polishing paste such as aluminum oxide, tin oxide, APF-free prophy paste, and low-abrasive dentifrice
- Air polishing

c) Locally applied chemotherapeutics:

Such as Arestin, Atridox, PerioChip, or Dentomycin

d) Subgingival irrigation

Antiseptic agents such as Peroxide, Listerine, or Chlorhexidine using a plastic irrigation tip.

1. Educate and motivate:

Dentists have to be not only dental care provider but also educator. As dentist we must educate and motivate patients to understand the importance of infection free oral cavity for the long term success of implant.

Patients personality and capacity for receptiveness must be checked before educating the patient. Patient should not be over burdened with medical or scientific terms. Educate one area of concern or one new technique at each visit. Ask the patient to demonstrate their home hygiene methods. Supply the patient with correct information and products.¹²

2. At home implant care

Implant home care is different and more important than the care for natural tooth. The differences in the soft tissues surrounding implant and tooth make the implant more susceptible to inflammation and bone loss from tooth deposits like bacterial plaque and calculus. If daily

biofilm removal and regular professional care is maintained, peri implant health will be optimized

It includes post-surgical home care, brushing, interproximal cleaning and water irrigation.

a. Post surgical home care

Post surgical home care begins immediately after the surgery to initiate healing and maintain clean surgical environment. Patient should be advised to use extra soft toothbrush and floss once a day except at surgical site. Patient should be advised to avoid hard foods such as popcorn kernels, chips which may lead to dislodgement of sutures and tearing of flaps. A soft diet is recommended for few days after surgery. Prescribed analgesics and antibiotics should be taken at mentioned intervals. Salt water rinses or nonalcoholic antimicrobial mouth rinse should be recommended two times daily.¹²

If implant is above gingival margin as in one stage implant then, advice the patient to brush twice daily with sulca brush, end tuft brush or powered brushes. Use a low-abrasive dentifrice with less than or equal to 2.0% NaF (sodium fluoride), as close to neutral (7.0 on pH scale), and no less than 6.2 on pH scale. Rinsing with non alcoholic antimicrobial mouthwash twice daily is advised. Rubber tip simulator or soft picks are recommended to massage the gingiva and stimulate gingival blood flow and fasten healing.¹²

b. Brushing

Patient should be advised twice a day brushing with modified BASS technique using a low abrasive dentifrice. Types of toothbrushes which can be included are soft bristle toothbrush, ultrasonic toothbrush and end tufted brushes. When choosing ultrasonic toothbrush chose the lowest head size and use on lower power setting. End tufted brushes may be used in difficult to access areas where normal toothbrush cannot reach.¹²

c. Interproximal cleaning:

Interproximal aids include floss, interproximal brushes. Flosses used in implant maintenance include proxifloss (plastic floss), braided flossing cord, satin floss, super floss, yarns and dental tapes.¹³

Foam tips, interproximal brushes, and disposable wooden picks are auxiliary devices that can be used as adjunctive to remove plaque and deliver antiseptic rinses to enhance their effectiveness. The size of interproximal area dictates the size of interproximal brush. Whereas larger spaces can be properly cleaned with a proxy brush such as StaiNo Interdental brushes, smaller interdental brushes, such as the Sulcabrush or Go-Betweens Cleaners are helpful in narrower interproximal spaces. An interproximal brush with a plastic-coated wire is usually recommended. Soft picks are also latex-free and safe to use around implants. Nonalcoholic antimicrobial mouth rinses with chlorine dioxide or chlorhexidine gluconate are often recommended.¹³

d. Locally applied chemotherapeutics and water irrigation

Nonalcoholic antimicrobial mouth rinses with chlorine dioxide or chlorhexidine gluconate are often recommended for inflammation, patients with dexterity problems, and/or an area that is difficult to access for cleaning. They reduce bacteria in the mouth, redness/swelling of the gingivae, and bleeding upon probing. Water irrigation units are beneficial when used one to two times daily following proper instruction for complex implant cases with hard-to-reach areas and for any patient who has any dexterity issues. It is important to take care to avoid the sulcus of the implant and not damage the peri mucosal seal.¹²

3. Professional hygiene implant care:

Professionally there are various steps to be followed for implant maintenance visits.

Initially assessment should be done visually to check any signs of inflammation such as redness, bleeding on probing, contour change. This should be followed by palpation of implant site starting from mucogingival junction towards the gingival sulcus to observe any exudation from the implant site. Probing should be done 3 to 4 months after implant placement. A plastic or flexible probe should be used with no more than 0.15 N pressure.¹² Next step is to assess for tooth deposits and residual cement. Floss can be used to check for calculus by inserting it in contacts on both sides of implant, wrap in circle, and crisscross in front. Move in a shoe-shining motion in the peri-implant crevice. Check floss, and if it is frayed or roughened, cement and/or calculus is present. Another way to check for calculus/cement is radiographically. In case of cement residue, saucer shaped radiolucent area surrounding the implant. In case of calculus, asymmetrical area can be seen.¹²

The next step is to ask the patient is to record if patient has any complaint of pain or mobility around the implant. Use visual analog scale to determine severity of pain. If the pain is present, it has to be evaluated if it is due to occlusal trauma, lack of osseointegration or infection. Testing for mobility can be conducted using a mirror handle to gently push on the implant crown. If mobility is present, test by placing two mirror handles on either side of each implant if access is possible. If bubbling of saliva occurs along the gingival margin of the restoration, the internal screw may be loose. Confirm with a radiograph, and record if there is a gap in the implant stack, as this can confirm a loose screw

The final step is radiographic assessment of bone level around the implant to evaluate the health of implant.¹²

Instrument selection

A proper instrument is one which removes plaque and any other deposits without scratching the implant surface.

Instrumentation for natural tooth and implant differ as natural teeth have sulcular epithelium and periodontal ligament which is lacking in implant.

The difference between the calculus found on tooth and implant is that, calculus on implants is softer and more supragingival than the tooth, thus it becomes easier to remove with short horizontal strokes. Scratches and gouges may affect the titanium-oxide layer, reducing the corrosion-resistant nature of titanium implants.¹⁴

Rough surface implants which are commonly used nowadays, if scaled with other metals which are not biocompatible with titanium, trace elements can become lodged on the surface, causing bacteria to adhere, which can result in peri-implant disease.¹²

Implant scalers

Implant scalers can be plastic, graphite, titanium coated or solid medical grade titanium. Plastic implant scalers and air powder spray systems should be avoided on coated implants as they leave a residue on it. These residues can hamper the healing process and bone regeneration.¹⁵

Titanium implant scalers can be used safely on titanium implant surfaces as they are thinner than plastic or graphite implant scalers, yet provide more strength to dislodge calculus and residue cement, which makes them more effective.¹⁶ Stainless steel scalers, metallic sonic, and magnetostrictive (i.e., ultrasonic) stainless steel inserts have all been found to gouge or scratch titanium and are therefore contraindicated for implant instrumentation. Ultrasonic scalers can be used if they are fitted with implant sleeves.¹⁷ Piezoelectric inserts with special implant insert can be used to safely and gently clean around implant.¹²

For narrow base implants use longer, multibent blade implant scaler with horizontal strokes to dislodge the calculus. For wide base implants use universal implant scaler with short horizontal strokes.

If there are exposed threads, shorter radius blade tip of an implant scaler should be used and clean horizontally, in a side-to-side motion, one thread at a time gently like stairs. For single implants with ball, Locator, and mini implants, use short horizontal strokes with a short radius blade instrument. If locator single implants are used without a Hader bar, debride around the Locator with the short-radius blade instrument using short horizontal strokes and inside the screw indentation on the top of the attachment. If a Hader clip bar is attached, adapt a thinner curved-radius blade tip implant scaler under the bar and use a side-to-side horizontal stroke to dislodge the calculus.¹²

Polishing the implant

Removal of bacterial biofilm, inhibit bacterial metabolism and removal of bacterial plaque are the goals of polishing the implant. Proper polishing around implants consist of using soft rubber cup with nonabrasive paste followed by thorough rinsing. Polishing agents consist of diamond particles, aluminum oxide, silicates, pumice and calcium carbonate. The ones acceptable for implants include aluminum oxide, tin oxide, APF-free, Pumice free prophylaxis paste and low abrasive dentifrice.¹⁸ APF (Acidulated phosphorous fluoride), coarse abrasive polishing pastes and air polishing are contra indicated for implants as they may etch the surface of implants. Currently, the only air-polishing system that has been proven safe to use on implants is the EMS AIR-FLOW® Perio powder (glycine, 25 microns) with the Perio Implant Tip.¹⁹ Air polishing is contra indicated for patients with respiratory, renal or metabolic disease, restricted sodium diets, infectious diseases, on diuretics or children.²⁰

Cumulative interceptive supportive therapy (CIST)

It is a sequential therapeutic procedure with increasing antibacterial potential and type of therapy based on the severity and extent of the lesion. It is:

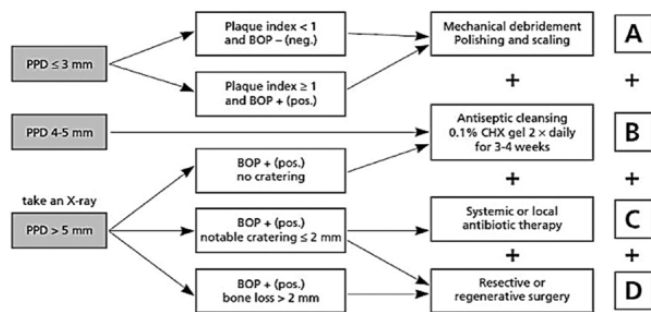
- a) Protocol of therapeutic measures

b) Depends on the clinical and the radiographic diagnosis

c) Cumulative in nature.

After probing, if the peri-implant sulcus allows more than 5 mm of penetration of a periodontal probe then a radiograph is taken. A microbiological sample is taken if there is direct evidence of bone loss. If the microbiological test shows anaerobic flora, then the patient is put on treatment: A and B, and in addition is placed on systemic antimicrobial therapy (C) with an agent specifically effective against strict anaerobes (Ornidazole-1gm for 10 consecutive days).

If there is considerable bone destruction, surgical procedures to correct the tissue morphology or application of GBR techniques may be necessary (D). This treatment would, however, only be adjunctive to the other measures (A, B, and C). The goal of this cumulative treatment approach is to intercept peri-implant tissue destruction as early as possible and to avoid loss of implant due to the loss of osseointegration. In 2004, this was modified and renamed as AKUT-concept by Lang et al. The basis of this concept is a regular recall of the implanted patient and repeated assessment of plaque, bleeding, suppuration, pockets, and radiological evidence of bone loss.²¹



CIST protocol(Figure 1)²¹

Conclusion

Dental implants are a major investment and dentists play an important role in protecting that investment for the patient. Implant success rate is measured over a 5-year

period after placement. Patients can expect a 1% a year failure rate after the first year due to improper postsurgical care, infections, or poor oral hygiene, but with routine in-office maintenance, implants can last a lifetime.¹²

According to the position paper of the Academy of Periodontology on Dental Implants in Periodontal Therapy, “Following restoration with endosseous dental implants, maintenance of the implant-supported prosthesis becomes a necessary and regular part of periodontal maintenance visit” Studies have convincingly demonstrated that long-term stability after periodontal and implant therapy is possible if patients practice good oral hygiene, avoid risks (such as smoking), and are included in a regular maintenance care program.¹²

Maintenance after completion of dental implant therapy has three components: measures taken by the patient; preventive measures taken by a dental health-care professional; and supportive therapy addressing the cause or sequelae of recurrent or residual disease. The period between two maintenance visits isn’t sufficient for mineralization of sub gingival bacterial deposits, thus less aggressive than scaling and root planing may be more appropriate for residual pockets. Repetitive clinical assessments made during maintenance should focus on recent change and new pathology. Given the lack of clinical validation of risk-assessment tools for programming recall intervals, the stability of the situation should be evaluated continuously, and the recall frequency should be adapted to individual patients based on longitudinal monitoring.⁶

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