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Peri-Implantitis and its Management - A Review

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Abstract

Dental implants have today, evolved to become a routine remedy in replacement of single or multiple missing teeth. Peri-implantitis is a condition affecting the hard and soft tissues around the implants, so their prevention, identification and treatment on a routine basis has become equally important. Periodic recalls with evaluation along with omission of risk factors (eg: smoking, periodontitis and systemic diseases) are fruitful precautions. Depending on the type of defects, non-surgical or surgical treatment can be planned to treat peri-implantitis cases. To treat such conditions, a large number of studies have been carried out, but there is still no gold standard treatment to successfully solve these complications.

Keywords: dental implant, peri-implantitis, non-surgical, surgical, treatment

Introduction

With advancements in dentistry, dental implants have become one of the most desirable choice for replacement of missing tooth or teeth. Successful studies with follow up periods of 16 months have demonstrated 82.9% positive results. [1] With proper care and adequate knowledge of the indications and contraindications, risk factors as well as the anatomical knowledge, dental implants seems to be a safe treatment modality.

Still in the past few years, there has been a lot of evidence on the occurrence of peri-implant infections, which represent one of the most recurrent complications that affect both the hard and soft tissues surrounding the implant. These complications vary from inflammation

and bleeding on probing to bone resorption around the implant and ultimately implant failure. [2] Failure of implant due to peri-implantitis is a caused due to the interplay of specific factors of the host with those of the biofilm. Also, the diagnosis and treatment of a peri-implantitis can be a significant issue to the dentist and it depends on a clinical approach which is backed by supporting evidence. Since dental implants are being very routinely placed in most of the practices, it is of utmost importance that clinicians are able to evaluate the condition of implants for their long-term survival and provide treatment strategies for failing implants. Therefore, different modalities for prevention and treatment of peri-implant disease should be implemented in dental rehabilitation postulations. This particular review throws some light on the pathogenesis, causative factors, risk factors and treatment of peri-implantitis.

Definition

"Peri-implantitis" term was coined by Mombelli in 1987, which in 1994, during the 1st European Workshop on Periodontology was modified by Albrektsson and Isidor who defined peri-implant mucositis as "an inflammatory response limited to the soft tissues surrounding a functioning oral implant" and peri-implantitis as "an inflammatory response that involves the loss of supporting bone in tissues surrounding an implant."[3] Later in the 3rd International Team for Implantology Consensus Conference, peri-implantitis was re-defined as "destructive inflammatory process affecting the soft and hard tissues around osseointegrated implants, leading to the formation of a peri-implant pocket and loss of supporting bone." Probing depth > 5 mm, bleeding on probing, suppuration and presence of plaque were selected as the clinical parameters. [4]

Etiology

Bacterial biofilms were observed in various studies as the principal causative factor for the initiation and advancement of infections around the implants. Peri-implantitis is identified as an anaerobic infection which is associated with multiple bacteria. [5] Frequently, different bacteria that can be ascertained are as Prevotella nigrescens, Prevotella intermedia, Streptococcus constellates, Porphyromonas gingival is, Tannerella forsythia, Treponema denticola and Aggregatibacter actinomycetemcomitans. [6] However, unlike periodontitis, peri-implant infections can display bacteria which are not usually considered as key periodontopathic bacteria. Particularly, Staphylococcus aureus seems to possess a key role for the occurrence of peri-implantitis. The bacteria display a high affinity to titanium according to a study by Salvi et al. [7]

Other risk factors comprise of: [8]

- History of periodontitis
- Smoking
- Systemic diseases – cardiovascular diseases, diabetes mellitus, immunosuppression
- Lack of keratinized gingiva
- Lack of compliance
- History of any failed implants

Diagnosis of peri-implantitis

Diagnostic methods developed for implants need to be sensitive to facilitate the detection of early signs and symptoms of any peri-implant infection and also for intervention before substantial bone loss occurs. A few parameters need to be assessed, which were given by Mombelli and Lang: [9]

a) Peri-implant probing: it is about 3-3.5 mm, which is done using a rigid plastic probe

b) Bleeding on probing: it has not been proven to be an authentic predictor for advancement of periodontal

disease, however its absence is considered to be a better parameter for establishing implant stability.

c) Mobility: is an indication of lack of osseointegration, but its use to diagnose initial implant disease is hardly of any use, rather it displays the final stages of dis-integration. Periotest and Resonance Frequency Analysis (RFA) are intended for evaluating the implant stability.

d) Radiography: the amount of loss of bone is an absolute indicator for peri-implant diseases. It is recorded by measuring the distance from the crest of the alveolar bone to the implant shoulder.

Establishing the diagnosis [10]

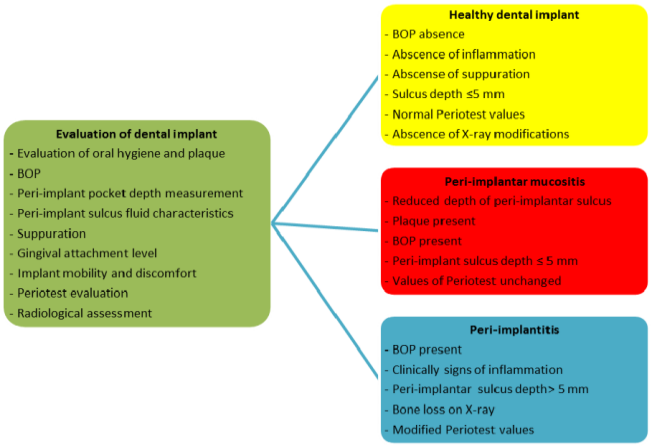

Figure 1

Treatment of peri-implantitis

A decision tree had been proposed in 2012 by Aljateeli M, Wang HL, Fu JH for treating peri-implantitis [11]

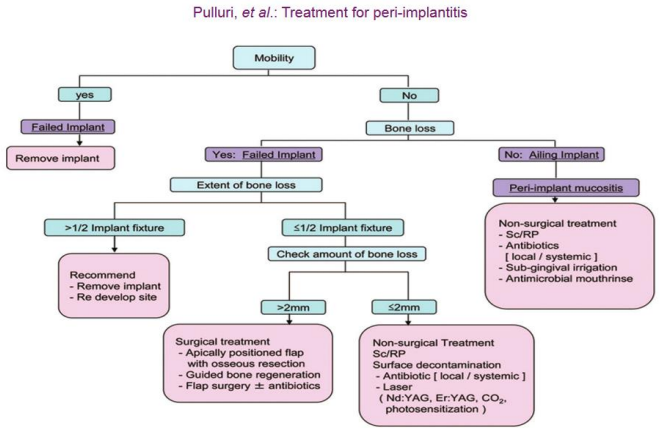

Figure 2:

Lang et al in 2004 gave consensus statements and proposals for clinical procedures associated with the arising complications and survival of implants: [12]

Nonsurgical therapy	Surgical therapy	Combination
Mechanical therapy	Implantoplasty	Cumulative interceptive surgical therapy (cist)
Adjunctive antimicrobials	Guided bone regeneration	
Photodynamic therapy	Peri-implant resective therapy	
Local drug delivery	Explantation	
Laser		

Table 1

Non-surgical therapy

Mechanical therapy approaches

It aims at surface biofilm removal, scaling and curettage. Various devices are at one's disposal for biofilm removal around an implant surface: [8]

- Teflon curettes
- Polishing brushes
- Rubber polisher
- Air powder flows
- Plastic, titanium or carbon curettes
- Specially modified tips meant for ultrasonic systems

Debridement of the implant surface is the primary step to treat peri-implantitis. Nonetheless, sometimes implant surface may hamper the mechanical therapy. Bacterial reduction in order to achieve healing can be challenging to attain with the only mechanical methods. Hence, adjuvant therapy options like lasers and antibiotics are suggested to treat peri-implantitis.

Adjunctive Antimicrobials

In a review by Javad et al., summarizing nine studies, local and systemic applications of antibiotics (e.g., amoxicillin,

tetracycline, metronidazole, doxycycline, ciprofloxacin and minocycline hydrochloride) led to considerable pocket depth reductions in a period between 1-6 years. [13] A success rate of 58% was noted by Leonhardt et al. when he treated peri-implantitis with surgical debridement and the use of different antibiotics and their

combinations (in cluding tetracycline, clindamycin, ciprofloxacin, amoxicillin + metronidazole).[14]

Schwarz et al in a study stated that when mechanical debridement with chlorhexidine 0.2% was performed, after 6 months, as compared with the baseline, there was reduced probing depth around implants, improved bleeding on probing and gain in clinical attachment.[15]

However in contradiction, Renvert et al. showed that there are no adjunctive benefits of use of antiseptic therapy along with mechanical debridement in peri-implant lesions with mean probing depth <4 mm but there appeared to be clinical improvements in pockets with a probing depth of > 5 mm. [16]

Photodynamic Therapy

It provides bactericidal properties against anaerobic as well as aerobic bacteria like Porphyromonas gingival is, Prevotella intermedia, Aggregatibacter Actino my cetemcomitans, Enterococcus faecalis, Streptococcus mutans. Bassetti et al. conducted a randomized prospective clinical trial covering a follow-up period of 12 months. In this, post mechanical debridement by titanium curettes, adjunctive photodynamic therapy was rendered to half the patients and minocycline microspheres were placed into the pockets around the implants of the remaining half of the group. 12 months later, there was a significant reduction in the peri pathogenic bacterial count and level of Interleukin 1-beta in both the groups without any significant variations in between them [17].

Hence, photodynamic therapy has to be considered as an adjunctive treatment option, along with mechanical methods. Since it is a fairly new idea, the data is very scarce and very few long-term-studies are obtainable. Additional studies and clinical trials are required for assessment of this modality.

Local Drug Delivery

In 2008, Renvert demonstrated the use of minocycline with mechanical debridement. Even after a period of 6 months, a considerable positive improvement was observed in probing depths as compared to controls [18].

In 2006, Persson advocated the use of Arestin, a local drug delivery system as antimicrobial therapy in the treating peri-implantitis. Following microbial evaluation, there was a reduced bacterial load of Aggregatibacter actinomycetemcomitans, Porphyromonas gingival is, Treponema denticola, Tannerella forsythia for up to 3 months [19].

Lasers

A variety of lasers have been used for the treatment of peri-implantitis: neodymium-doped: yttrium aluminium garnet (Nd: YAG), Erbium: yttrium aluminium garnet (Er: YAG), Diode laser and Carbon dioxide (CO2) laser. Minimal absorption of the laser must be made certain with the objective to protect both the implant and the tissue.

As compared to mechanical procedures along using plastic curettes, Er: YAG laser displayed noticeably better outcomes in factors like bleeding in cases of peri-implantitis. However, there were no such differences in plaque scores, gingival recessions, probing depths and clinical attachment levels visible, although the same factors had improved in both the groups [20]. Treatment with a Carbon dioxide laser of 308 nm led to acceptable results in an environment of anaerobic bacteria [21].

A systematic review in 2012 was conducted by Muthu kuru to assess the safety and effectiveness of nonsurgical treatment of peri-implantitis. He stated that administration of antibiotics or use of lasers like Er: YAG can be used as an adjuvant treatment modality for submucosal decontamination around implants. It might reduce clinical signs of peri-implantitis to a higher level

as compared to using curettes with chlorhexidine irrigation as adjuvant therapy [22].

Surgical therapy

The surgical therapy merges the above mentioned non-surgical therapy theories with that of regenerative and/or respective procedures. All surgical protocols should start with defect debridement and decontamination of the implant surface. The main goal of surgical therapy is to create a direct access to the infected site, which would help in its clean-up and removal of granulation tissue. This exposes the cavities of bone marrow which will allow the cell proliferation that eventually assist in healing.

Different procedures of surgical treatment include

Surface polishing / Implantoplast

It is a procedure in which the exposed surface of the implant is smoothened to lessen the plaque formation and ease its removal [23]. The most important priority here is to stop the disease progression and to attain a site which is self-maintainable for the patient. The topography of the implant should be modified with diamond burs at high speeds and polishers to achieve continuous and smooth surfaces. These steps should be performed before proceeding to any osseous respective therapy.

Guided Bone Regeneration (GBR)

In general, regenerative therapies comprise of mechanical debridement and grafting procedures along with the use of membranes. Membranes protect the graft material and also help in providing space which is required for new tissue formation. Originally the use of GBR initiated with treatment of periodontal disease in order to reduce migration of connective tissue and epithelial cells in the field, but also by facilitating initiation of bone cells and ligaments to repopulate the root surface [24].

Roos-Jansaker et al. in 2007 demonstrated positive results to therapy in sites of peri-implantitis (there was reduction in pockets ranging from 2.9–3.4 mm and new bone fill of about 1.4–1.5 mm) either treated with only bone grafts or in combination with a resorbable collagen membrane.

In 2012, Wilt fang et al. in a clinical trial reported significant bone fill (3.5 mm) over a period of 12 months follow up, in which surface decontamination was carried out in peri-implantitis sites and autogenous and xenogeneic bone graft was later used for regenerative flap surgery. There is a further requirement of well-controlled studies to establish that GBR can be used as an effective regenerative treatment modality for treating of peri-implantitis [25].

Peri-Implant Respective Therapy

On the basis of the defect type, respective surgery can be implemented for the eradication of peri-implant infections, and on the other hand regenerative modalities can be used to fill defect sites. The primary concept of this therapy includes the elimination of the peri-implant osseous defect using osteoplasty and osteotomy techniques.

It is indicated in moderate to severe horizontal bone loss, moderate (<3 mm) vertical bone defects (1 and 2 wall bone defects), reduce the overall pocket depth and implants which are positioned in the unaesthetic areas. Respective surgery seems to be proven to effectively decrease bleeding on probing depths, probing depths, and inflammatory clinical signs. Implantoplasty can be used as a viable adjuvant along with respective surgery to decontaminate and smoothen any exposed implant surface, caused by peri-implant infections [26].

Conclusion

In 2014, a review by Andrea Mombelli and Heitz Mayfield stated that 12 months following treatment of

peri-implantitis cases, successful treatment outcomes can be attained in most of the patients. There are supportive short-term results achieved in various studies, but due to the shortage of any long-term follow-up studies, no ideal peri-implantitis therapy is established till date. There are various studies which have implemented various study designs in different populations, also experimenting on separate materials used, but the small size of the samples and short follow-up periods after the treatment phase have proven to be the drawbacks.

Prevention of peri-implantitis is of the utmost importance. It vastly depends on an accurate treatment plan, an approach for implant placement which is atraumatic to the patient and proper follow-ups post treatment with self as well as professional oral hygiene maintenance. Above all, careful attention needs to be paid to risk factors such as cigarette smoking, medical conditions and periodontitis either in the active state or any previous history of the same.

Recommendations from a few studies include [27]

- Before beginning any treatment, a thorough assessment of the oral hygiene, cessation of any habit if present and prosthetic evaluation needs to be undertaken
- Surgical intervention to be done when the non-surgical methods fail to effectively demonstrate the desired results
- Postoperative medication and oral rinses must be advised to the patients
- Follow up every 3-6 months for maintenance, including patient education as well as oral hygiene instructions and removal of supramucosal biofilm if needed.

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