Peri-implantitis and its management: A Review

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ABSTRACT

Implant failure is a major concern for implantologists and knowledge of its management is very prime in clinical practice. Periimplantitis is defined as an inflammatory response in which there is a loss of the supporting bone of the implant. Clinical signs of infection such as hyperplastic soft tissues, suppuration, colour changes of the marginal peri-implant tissues and gradual bone loss signify failure of implant. This site-specific infection may have many features in common with chronic adult periodontitis. Implant failure is also accompanied by surgical trauma, micromotion and overload. The absence of osseointegration is characterised by mobile implant and radiolucency leading to failure of implant. Progressive marginal bone loss without marked mobility is also a key factor in implant failure. The purpose of this concise review is to discuss various risk factors for implant failure, evaluation of parameters leading to implant failure and their management.

KEY WORDS: Implant failure, peri-implantitis, marginal bone loss, implant mobility.

INTRODUCTION

Dental implants are acquiring a lot of popularity in treatment of partially and completely edentulous patients. Survival rates for implants in the mandible are 92.6% and in maxilla implant are 98.5%. Before planning an implant one must recognize the difference between implant failure, survival, and actual implant success. Implants that remain intact in the oral cavity are considered to be survived implants. Diseased implants that are not surrounded by healthy tissues are considered survived implants. Various criteria need to be analysed for any implant to be considered as successful hence it is difficult to assess the number and rates of successful implants. Implant-supported restoration offers a good treatment result. However, failures that mandate immediate implant removal do happen. The consequences of implant removal menance the clinician's efforts to achieve satisfactory function and further cost for the patient. Reported predictors for implant success and failure are generally divided

into patient-related factors (e.g., general patient health status, smoking habits, quantity and quality of bone, oral hygiene maintenance, etc), implant characteristics (e.g., dimensions, coating, loading, etc), implant location, and clinician experience[1-3]. The aim of this review is to describe different options and treatment modalities to deal with periimplantitis.

DIFFERENCES IN ANATOMY BETWEEN TEETH AND IMPLANTS

Oral mucosa with keratinized tissue surrounds the crown of the tooth[4]. On bacterial accumulation, this tissue becomes inflamed resulting in gingivitis. These tissue get converted to peri-implant tissue once the implant has been placed. The peri-implant tissue after getting inflamed leads to bone loss and periodontal disease. When this bone loss is associated with a dental implant, it is known as peri-implantitis. Natural teeth have a sensory center that is called pulp chamber which is responsible for transmission of sensations to the tooth. **(figure:1)** Under pathological condition, patients may experience pain via the nerves present in the pulp chamber. This pain can elicit patients to visit a dentist. Implant failure thus get ignored because they lack such sensory center (pulp chamber) [5]. Natural teeth are supported and stabilised by periodontal ligament. Implants require bone support because they lack periodontal ligament. **(figure:2)** Cellular difference involve presence of large number of neutrophil, granulocytes and macrophages in peri-implantitis than in periodontitis. A "self-limiting" process exists in the tissues around teeth, which is a protective connective tissue capsule that differentiates the lesion from the alveolar bone [6]. Such a self-limiting process does not occur in peri-implant tissues, and the lesion invades the alveolar bone. Such anatomical differences make the implant more prone to bacterial invasion and inflammation. Thus frequent follow ups are must during the implant procedure.

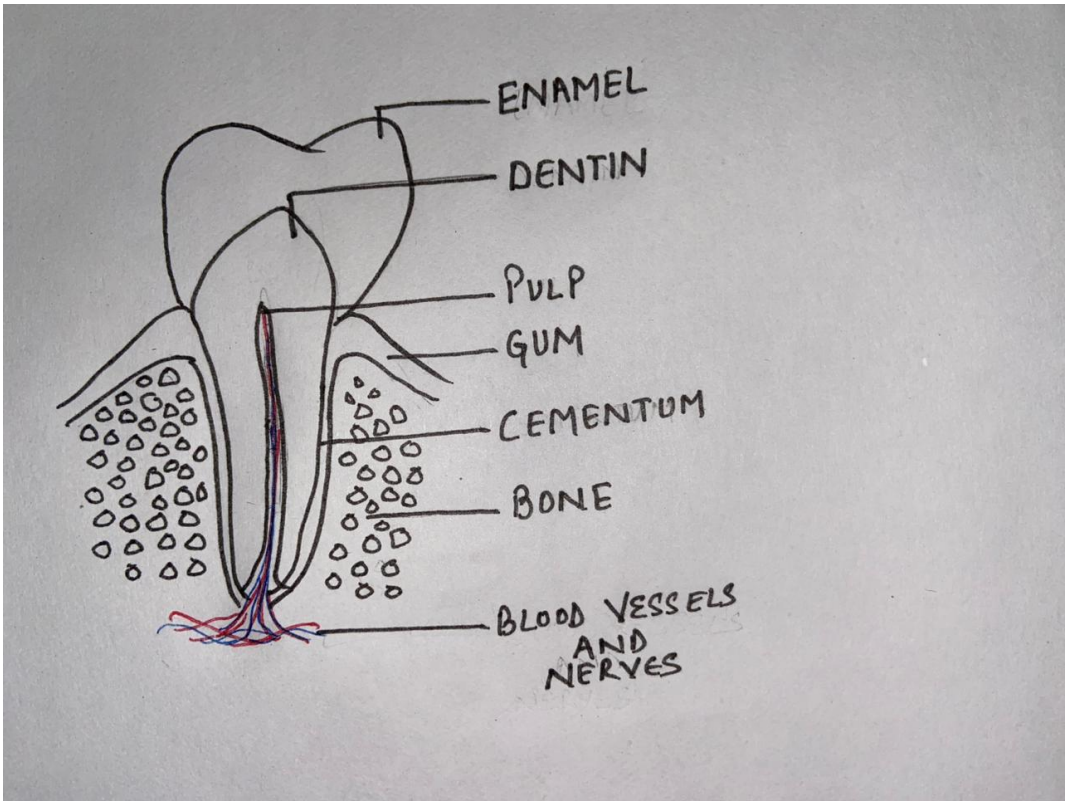

Figure: 1 Anatomy of natural tooth

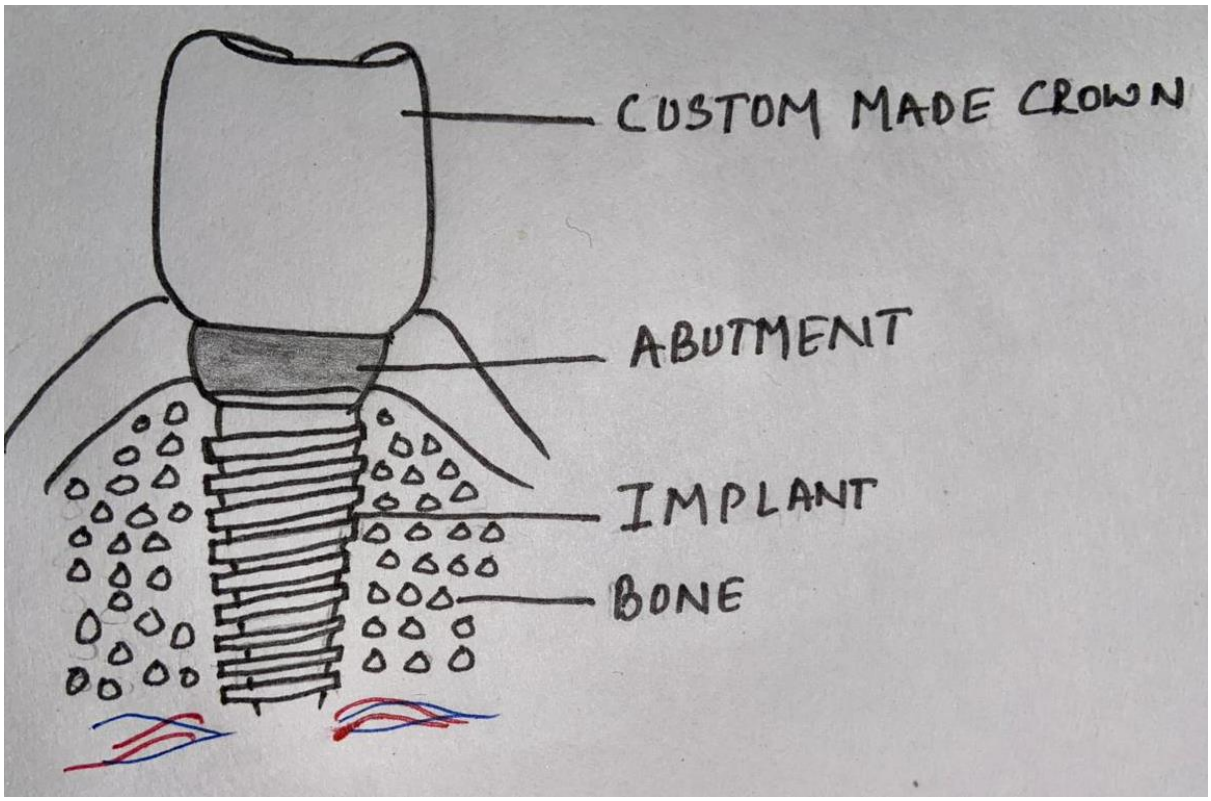

Figure:2 Diagrammatic representation of dental implant

RISK FACTORS FOR PERI-IMPLANT DISEASE

Peri-implantitis is a growing concern following the placement of dental implants [5]. Peri-implantitis is characterized by alteration in the level of the crestal bone along with bleeding on probing with or without concomitant deepening of peri-implant pockets. Pus is a common finding in peri-implantitis sites. A study published in 2016 analyzed 588 implant patients for the prevalence of peri-implantitis. The study defined peri-implantitis as bone loss over 0.5 mm and bleeding on probing. An astounding 45% of patients presented with the disease. A concept review published in 2015 found the prevalence of peri-implantitis to have a range of 4.7% to 43% at the implant level. Peri-implantitis is a concern that needs to be laid focus on and considered both prior to and post implant placement. The most important and crucial cause for peri-implantitis is bacterial plaque accumulation around the implant site. Several risk factors are associated with the presence of peri-implantitis. The most significant risk factor is:

1. **Poor oral hygiene-** Poor oral hygiene is strongly linked with peri-implant disease[5].
2. **Smoking-** Prevalence of peri-implant disease is highly influenced by smoking. The consumption of tobacco leads to bacterial colonization and alters the microbiome in the peri-implant tissues.[13] Smokers are seem to have double the bone loss as compared to non-smokers.[14]. Therefore, we should be very careful in the placement of implants in the smokers as it is a very prime factor in failure of implant.[8-10]

3. **Periodontal disease-** A study done in 2016,revealed that patients having a history of periodontal disease had double chances for developing peri-implantitis in comparison to patients with no history of periodontal disease[8].Hence Periodontal disease have also been strongly linked with peri-implantitis in earlier studies [11]. It is suggested that the periodontal pathogens colonize the tissues surrounding the implant resulting in peri-implantitis. Hence treatment measures for the periodontal disease should be administered before placing an implant to ensure success of dental implant.
4. **Mode of attachment of implant -** Cemented versus screw-retained implants may also present as risk factors for peri-implantitis as cement-retained Implants are proved to have an high prevalence of peri-implantitis in comparison to screw-retained implants. This is most probably due to the presence of extra cement in the sulcus that enhances the bacterial colonization[11]. However, a study published in 2015 suggessted that if the cement is removed properly then there is no difference in the prevalence of peri-implantitis in cement versus screw-retained. Proper technique in placement of cemented implant will always remove the extra cement and promote proper healing of bone surrounding the implant.
5. **Diabetes-**Diabetes being a systemic factor is associated with increased risk for peri-implantitis. It is said that diabetic patients are more prone to periodontal disease and other infections; however, their susceptibility to peri-implantitis is still a controversy. However studies suggest that diabetic patients with poor metabolic control have a high risk for peri-implant disease[12]. A well-controlled diabetes will always ensure the best prognosis of the implant. Studies have been useful for clamining the association between diabetes and peri-implantitis.

Parameters used for evaluating implant failure

1- **Marginal bone loss(MBL):** MBL is defined as the bone loss during the bone-healing period for two-stage implants, existing around non-submerged dental implants which may result in implant failure. Theoretically, both biological and biomechanical factors may result in MBL during bone healing. Plaque control, smoking and wound-healing capacity are host related factors. Implant design is also related to MBL which involve, the implant surface and neck microthreads. Other contributing factors, are surgical trauma and different restorative procedures, which add in the process of bone loss. Marginal bone loss (MBL) around dental implants is a major concern, and extensive bone loss has been regarded as one key factor contributing to implant failure. Studies in 1980 used intra-oral radiographs for the assessment of Marginal bone loss, since then it has been regarded as a critical criteria to assess implant success. 1–1.5 mm of bone loss during the first year after loading and <0.2 mm annually are considered as the criteria for defining a successful dental implant. In 1986, Albrektsson, et al. suggested success criteria for

MBL. He suggested that ,during the first year after abutment placement, 1 mm of MBL is allowed followed by 0.2 mm per year. Today, these criteria is still referred to as the "gold standard" for implant success. Due to the abundance of data regarding MBL, and a better understanding of bone and soft tissue behaviour around the implant neck and body this criteria is considered to be inaccurate depending upon today's wide variety of implant systems. Implant failure has some clinical symptoms, such as pain, mobility, etc. However, MBL is rarely symptomatic but may endanger long-term implant survival. The MBL rate changes at different stages during the life of an implant. Given that while calculating the MBL data, it should not include a smooth polished neck portion. First year MBL calculations are not considered in Long-term prognosis of an implant. Follow-up is essential to determine and predict result. According to Alberktsson`s, clinical pattern for evaluating the MBL after the first year were low rate MBL over the years low rate MBL in the first few years followed by a rapid loss of bone support, high rate MBL in the first few years followed by almost no bone loss, and continuous high rate MBL leading to complete loss of bone support. Clinically MBL assessment should be easy to apply using radiographs and should allow a quick gross comparison to previous data. Together with Albrektsson's clinical parameters, it should help the clinician assess a given condition and predict its future clinical course, as well as help in decision making regarding additional tests/therapy (i.e., radiographs, occlussal analysis, prosthetic evaluation, surgical intervention, etc), frequency of follow-up, and hygiene appointments. [12].

2- **Clinical signs of infection-** Complications such as swelling, fistulas, suppuration and early/late mucosal dehiscence are the most common infections seen during the healing period. They are closely related to implant failure. Nevertheless, early wound dehiscence can also be present in relation to retained sutures, inadequate flap designs, or premature wearing of a denture. Early signs may be a mark of a much more critical result because of disturbance of the bone healing process that hinders the integration of the implant. Progressive marginal infection which are considered to be late signs can lead to implant failure. However, clinical signs of infection such as hyperplastic soft tissues, suppuration, colour changes of the marginal peri-implant tissues, etc are signs which need an intervention. Hence, signs of infection either early or late along with other parameters such as radiographic changes and mobility can be used in the predicting the fate of a dental implant. In the absence of the latter parameters, clinical signs of infection that if left untreated, might lead to an implant failure. In other words, signs of infection point to more a complication than a failure [14].

4- **Clinically marked mobility:** Mobility of implants is the key sign of their failure. This clinically noticeable situation can, occasionally, be present without distinct radiographic signs of

bone changes. Several different kinds of mobility: horizontal, vertical and rotation mobility have been recognized. The reverse-torque test was proposed to discover mobile implants and the perio test device can be used for a better evaluation of horizontal mobility. While rotational mobility may reflect an immature bone/implant interface, horizontal and vertical mobility on the other hand, may be associated with bone loss and the presence of soft tissue capsule [14].

5- **Radiographic signs of failure:** The radiographic examination remains one of the main tools for recognition of failed implants in clinical practice. The most important factors for making an appropriate radiographic assessment of the implant conditions are the quality of the radiographs together with the examiner experience. Standardized periapical radiographs should be taken at regular follow-up intervals to detect peri-implant radiolucency and/or progressive marginal bone loss. At this point, the picture of peri-implant radiolucency suggests the absence of direct bone-implant contact and possibly a loss of stability, whereas in the case of increased marginal bone loss, the implant can be stable [14].

Implant replacement

The success of implants replacing failed ones at the exact site has been reported. Using the commercially pure titanium screw-shaped implants, it has been suggested that when an implant is lost, a flap should primarily cover the entrance to the site and after 9-12 months, a new implant can be replaced at that site1.Evian and Cutler report immediately replacing 5 failed screw-type, commercially pure titanium implants with larger-diameter, hydroxyapatite coated implants in the same sockets. They suggest that a 1- year healing period may not be necessary provided the socket can be prepared to eliminate thread grooves and invasive soft tissue; the implant replacement is larger in diameter than the original implant; and sufficient available bone remains for the procedures. Recently, the implant failure rate was compared between a machined surface and a TiUnite surface used to replace failing implants.3Of the 29 machined surface implants replaced by implants with the same surface, 6 failed (79.4% survival rate) compared to the machined surface implants replaced by TiUnite surface implants where only 1 failed. Of the 10 TiUnite-surface implants replaced by implants with the same surface, none failed. The difference in failure rate between machined-surface and TiUnite replacement implants was at the same location, an overall survival rate of 71% was reported with a mean follow-up of 19.4±11.4 months. Replacement of a failing implant involves the challenge of achieving osseointegration in a compromised bone site. When treatment cost and additional procedures to the patient are considered, the clinician needs information regarding the predictability of replacing a failed implant. This information should be discussed with the patient for informed consent for the subsequent attempt. There is still a lack of sufficient evidence-based data regarding failed implant replacement. Meticulous removal of granulation tissue on the failed implant site and the use of wider implants with improved surfaces could improve the outcome of re-implantation. Further research with a large cohort for a long follow-up period is warranted. An implant that replaces a previously failed one could

serve as a predictable procedure with reasonable survival rates. However, these survival rates are lower than the rates reported for first attempt single implant placement. Clinicians should remember that once an implant has failed, replacement of that implant is subjected to at least all the initial factors that led to the failure. Statistically significant. In a study that assessed survival and success rates of single dental implants replacing a previously failed implant replacement of that implant is subjected to at least all the initial factors that led to the failure [13].

Planning phase

In order to achieve a successful implant it is very important to enable proper oral hygiene and maintenance for a long period. It is better to prevent peri-implantitis than treating it. Before initiating the implant placement one must perform the periodontal diagnosis of as it is considered as a risk factor for peri-implantitis. Patients must have a good periodontal status and to ensure the same introduction and enforcement of proper dental hygiene protocol. Professional preventive care along with mechanical plaque removal methods are considered to be most effective in preventing the failure of implant [5].

Oral home care

It includes home care instructions educating patient to brush twice and use interdental aids. Proper brushing ensures effective plaque removal around natural teeth, implants and implant based restorations. However Modified bass technique is considered as the most effective and ideal brushing technique against plaque removal. Even though flossing are considered as an ideal aid for interdental cleaning, studies have shown that there were no sufficient evidence to prove the same. Wood sticks and interdental brushes were found superior to flossing. An important part of treatment includes instructing the patient about how to effectively remove plaque around teeth and implants. This should be reinforced on regular basis to enhance the prognosis of dental implant.

Professional care

Disease control

Presence of any disease like periodontitis prior to implant placement leads to failure of implant. Whereas Peri-implantitis occurring post implant placement needs to be controlled as soon as possible to prevent bone loss. A recall period of 6 months is adviced for patients with no complications. For patient having peri-implantitis recall visits are should be maximised. Recall visits must include reinforcement of proper oral hygiene instructions along with professional cleaning of the plaque to ensure early diagnosis of any pathology which may lead to failure of implant [5].

Health maintenance

A study performed by Costa et al showed that patients with peri-implantitis has better prognosis in treatment of peri-implantitis in patient acquiring proper professional care versus patient who had not acquired professional care. Factors like smoking, diabetes, periodontal disease increase the frequency of recall appointments. During subsequent recall visits it is imperative that oral hygiene education in assessed and reviewed with the patient in order to maintain compliance. During these visits emphasise should be made on areas where plaque removal is insufficient. Regular visits remind patient about their responsibility to maintain their implant and ensure success of implant. area of concern should be probed at each recall appointment and diseased pocket should be treated. Scaling should also be done in order to reduce the chances of peri-implantitis, but

scaler is softer than titanium implant and hence it leads to accumulation of remnants left behind after scaling. Nevertheless it is adviced to remove plaque and calculus effectively from both implant and teeth and hence metal scaler and curettes should be used on implant restorations.

Follow-up and evaluation of health and disease around implants

Home care and oral health status are very important factors to be evaluated during follow-up of implant placement. Defining factor of peri-implantitis are bleeding on probing and marginal bone loss and hence these must be evaluated during the follow-up. If proper home care is maintained and no inflammation is present it signify successful implant placement.

Conclusion

Implants although are proven to be effective in long term treatment option for restoration of edentulous areas. One should always remember it is not necessary that implants which have survived are successful. Successful implants are those which are fully functional and remain intact in the alveolar bone. Implant failure is called as peri-implantitis. Controlling pre-existing disease and assessing risk factor before placing an implant will aid in preventing implant failure. A strict regime of follow-up with a professional care is necessary for maintaining implant and to prevent disease. Early diagnosis and eradication of inflammatory factors around implant will improve the long-term prognosis as well.

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