Review Article

Contributing factors for peri-implantitis in endosseous dental implants - A review

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ABSTRACT

Aim: The aim of the study was to estimate the role of the risk factor for peri-implantitis in patients receiving endosseous dental implants. **Background:** Failure of dental implants is a major concern in spite of its large success rates. Endo-osseous implants are those prosthesis placed to compensate the missing teeth in the oral cavity and restore the normal form and function of occlusion. Chronic alcoholism, smoking, poor oral hygiene, and other systemic disturbances interfere with the cellular and molecular mechanisms potentially responsible for bone growth around the prosthesis. **Materials and Methods:** Patients reporting to Saveetha Dental College, Department of Implantology from the January 2016 to November 2017 were assessed for alcohol and tobacco usage using AUDIT SCORE and Fagerstrom questionnaire and were also screened for peri-implantitis. The information with regard to the anatomical site, age, gender, and occupation were evaluated along with the clinical and radiographical examination. The data were extracted. Then a correlation analysis was initiated using multiple regression models and results analyzed. **Result:** There was the increase in the incidence of peri-implantitis in patients with the habit of smoking, poor oral hygiene, and those with implants placed in the maxillary bone.

KEY WORDS: Alcoholism, Dental implant, Endosseous implant, Peri-implantitis, Rates of survival, Smoking

INTRODUCTION

In recent times, increased social awareness among the general public about the general dental health has opened scope for opting to the dental prosthesis for replacement of missing teeth, including dental implants even in the rural population. Implant systems today, have come a long way to provide comfort and long-term success in patients requiring implant-supported prosthesis as part of oral rehabilitation. The ongoing research in this area has made it even possible for dental implants to be available at very affordable cost, to enable the technology reach the masses.

Implant failure has drastically reduced, mainly due to the research contribution in areas of good sterilization, diagnostic aids, three-dimensional imaging, bone grafting, the composition of the metal used, implant design, implantation techniques, and to name a few. Although dental implants are very promising today, peri-implantitis[1] and implant failures are still a cause for major concern. Further research is on to identify areas which continue to contribute to implant failure.

Peri-implant mucositis and peri-implantitis are two common predisposing conditions contributing to implant failures today. According to the 6th European workshop on Periodontology (EWOP),[2-4] peri-implant mucositis is defined as a reversible inflammatory reaction in the soft tissues surrounding a functioning implant. Peri-implantitis is defined as the presence of inflammation characterized by the loss of supporting bone around an implant in function.

In a consensus report from the third EWOP in 1999, according to suggested success criteria for integrated and healthy implants, the marginal bone loss should not exceed 2 mm between prosthesis installation and 5 years of follow-up should be given.[5] There are various risk factors that lead to peri-implantitis such as the presence of periodontitis, smoking habit, alcoholism, poor oral hygiene, diabetes, and other systemic and genetic traits.[6] Patients with a history of chronic periodontitis have a higher prevalence of peri-implantitis (28.6%) than healthy patients (5.8%).[7]

Access this article online	
Website: jprsolutions.info	ISSN: 0975-7619

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Received on: 19-02-2017; Revised on: 25-04-2018; Accepted on: 13-05-2018

A study by Koldsland *et al*. also indicates that individuals with a history of periodontitis are prone to peri-implantitis if they had peri-implant bone loss of 2 mm[8] because the pathogenic flora in peri-implantitis is similar to that found in periodontitis and periodontal pockets are probably a reservoir of microorganisms colonizing implant surfaces.[9] A study by Ferreira *et al*., higher plaque scores were associated with peri-implant disease and a very poor oral hygiene status.[10]

A study by Rodriguez-Argueta *et al*. showed that smokers had an increased risk of infection, implant loss, mucositis, and peri-implantitis than non-smoking patients. The pathogenic mechanisms of smoking may be explained by the toxic effects of the more than 4000 toxins present in cigarettes. Nicotine is a potent vasoconstrictor that reduces blood flow and nutrient delivery to healing sites. Some compounds of tobacco also act as chemotactic substances that enhance tissue destruction by enzymes released by neutrophils and macrophages.[11] Peri-implantitis was more frequent in smokers (9.2%) than non-smokers (5.3%).[12] Among them, a rate of peri-implantitis and failure of implants due to alcoholism are on the increase. Alcohol consumption may lead to Vitamin K deficiency, leading to disruption in the production of prothrombin, thus affecting coagulation mechanisms. Alcohol consumption is associated with deficiencies of the complement system, alteration of the neutrophil function and modulating T lymphocyte activity. Moreover, some substances contained in alcoholic drinks such as fusel oil, nitrosamines, and ethanol, can cause bone destruction and block the stimulation of new bone formation.[6] A study by Galindo-Moreno et al. concluded that peri-implant marginal bone loss was statistically linked to alcohol consumption of >10 g per day and that alcohol-induced more serious peri-implantitis than cigarettes.[13]

Failure of dental implants due to biological and systemic reasons is one major area of concern, in spite of its large success rates due to technology. Endosseous implants are those prosthesis placed to compensate the root of the missing tooth in the oral cavity and restore the normal form and function of occlusion when a superstructure is placed. Chronic alcoholism interferes with the cellular and molecular mechanisms potentially responsible for bone growth around the prosthesis. Thus, this research aims at estimating the factors that could potentially contribute as a risk factor for peri-implantitis in patients receiving endosseous dental implants.

MATERIALS AND METHODS

Ethical approval for the study was obtained from the Saveetha Research Board Ethics Committee. Patients with implants who reported to Saveetha Dental College, Department of Implantology from the January 2016 to November 2017 were examined, and the health status of the implant was assessed. The information with regard to the duration, anatomical site, age, gender, diabetic status, alcoholism, and smoking habits were evaluated along with the clinical and radiographical examination. An audit score and Fagerstrom test were done to assess their alcohol and nicotine dependence, respectively. Hemoglobin A1c test and oral hygiene index (s) index were calculated to check their glycemic profile and oral hygiene status, respectively. The extracted data were used a correlation analysis was initiated using multiple regression models, and results were presented with an odds ratio.

RESULTS

Of 1041 patients screened with implants 46 patients had peri-implantitis. Among whom 12 patients were between 20 and 40 years of age and 34 patients were above 40 years of age. The odds ratio was 0.4 ± 0.55, when age was considered. 19 males and 27 females had peri-implantitis, and the odds ratio was 0.91 ± 0.60. When the anatomical location of the implant was considered 29 patients had peri-implantitis in the maxilla, and 17 patients had the same in mandible, and odds ratio was 1.41 ± 0.61. When smoking habit was considered 27 smokers and 19 non-smokers had peri-implantitis with an odds ratio of 0.47 ± 0.60. When alcohol dependence was considered 25 alcoholics and 21 non-alcoholics had peri-implantitis with an odds ratio of 0.19 ± 2.26. Among diabetic 29 diabetics and 17 nondiabetics had peri-implantitis with an odds ratio of 1.44 ± 0.615. When oral hygiene was considered 31 patients with poor oral hygiene and 15 patients with good oral hygiene had peri-implantitis with an odds ratio of 4.95 ± 0.72.

DISCUSSION

Implant failures are an inevitable outcome in cases of medically compromised patients and those with adverse habits. The implant acceptance by the host tissue and osseointegration is governed by various factors. The patients were screened, and the data were divided and recorded. Patients were divided into two groups mainly those with peri-implantitis and those without peri-implantitis.

Oral micro-organisms are a major factor for peri-implant disease; thus, it is very important to detect and eliminate their populations. Lindquist *et al*.[14] found an association between poor oral hygiene and peri-implant bone loss at 10-year follow-up mainly in the smoking population. Ferreira *et al*.[10] explained the relationship between full mouth plaque score and peri-implantitis in subjects with poor oral hygiene.

There are also many clinical studies that have proved that periodontitis and peri-implantitis to be associated with each other.[7,10,15,16]

Smoking is another major risk factor for peri-implantitis.[12] An association between smoking and peri-implant disease has also been proved in other studies.[17-20] Haas *et al*.[21] found that cigarette smokers had higher scores in bleeding.

Systemic disorders also have an influence on peri-implantitis. Diabetes delays healing and increase susceptibility to infection. A study by Ferreira *et al*.[10] also describes the association between diabetes and peri-implantitis.

Alcohol consumption is considered as one of the major causes of peri-implantitis. Galindo-Moreno *et al*.[13] have studied the association between alcohol consumption and marginal bone loss and that alcohol-induced more serious peri-implantitis than cigarettes. Studies on genetic traits have shown conflicting results with no conclusive evidence either proving or disproving an association[22] Gruica *et al*.[18] did, however, find that interleukin-1 (IL-1) genotype-positive smokers had a significantly greater risk of developing biological complications and/or peri-implant bone loss. This was in contrast with IL-1 genotype negative smokers, who did not appear to be at any higher risk.

Several studies have also been done to assess the success rate of implants based on their anatomical location in the oral cavity to determine the influence; the bone quality had on the implant.[23,24] Bone quality has been classified into four categories by Lekholm and Zarb[25] based on the degree of corticalization. High percentages of implant failures occur mainly in type four bones (little cortical bone combined with less mineralized cancellous bone and larger trabecular spaces).[24,26] In fact, this kind of bone, because of its biomechanical characteristics, often does not provide the implant the adequate primary stability which is indispensable for a good bone-to-implant contact formation.[27] This was confirmed in the present study. Age and gender had no influence on peri-implantitis.[28]

Clinical Examination

1. Clinical sign: A periodontal probe is an essential tool for the clinical diagnosis of peri-implantitis. Probing with a light force of 0.25 N does not cause peri-implant tissue damage while evaluating peri-implant disease. Clinical signs of peri-implantitis are bleeding on probing (BOP) in conjunction with peri-implant pockets >5 mm with or without suppuration. In fact, BOP and suppuration indicate that the presence of inflammation and infection. Because healthy implants generally have probing depths that are <3 mm. A peri-implant pseudopocket could be present as soft tissues that are positioned above the implant.[6]
2. The clinically marked mobility of implants is the key sign of their failure. This clinically noticeable situation implies that there is an underlying bone loss[28,29] and the Periotest device can be used for a better evaluation of horizontal mobility.[30]
3. Radiographic signs of failure - The radiographic examination is one of the main tools for examining failed implants in patients.[31]

The treatment strategies followed for the elimination of inflammation in periodontal tissues are mechanical debridement, pharmacological management, surgical procedures, and laser therapy.[4] The elimination of the bacterial colonies which are the major cause of peri-implantitis.[32] Treatment is divided into non-surgical phase (mechanical debridement with or without antimicrobial therapy) and a surgical phase (resective or regenerative techniques.[33]

Nonsurgical treatment is done using curettes made of carbon fiber, plastic or titanium. These instruments must be handled with care as they can damage the implant surface and lead to the formation of mechanical retention areas[34] and increase the disease process. The supragingival plaque can be removed during regular oral hygiene practices. Pharmacological management includes systemic and local antibiotics - as well as antiseptic, and antibacterial agents such as chlorhexidine (CHX) used for mechanical debridement or surgery. Schwarz *et al*.[35] showed a significant improvements in BOP, periodontal pocket depth, and clinical attachment loss at 6-month recall when adjunctive 0.2% CHX irrigation and gel were used along with mechanical debridement of implant surfaces. Lavigne *et al*.[36] found no clinical or microbiological effect from irrigation with 0.12% CHX when the pocket depth was >3 mm. Ciancio *et al*.[37] found that the twice-daily use of Listerine (a mouthrinse containing essential oils) was better at reducing plaque levels and BOP than a placebo mouthrinse. Studies differ with respect to the type of antibiotic, dosage, delivery system, duration, and commencement of administration, and data on patient compliance and adverse effects have not been reported.[38]

The typical saucer-shaped lesions characteristic of advanced peri-implantitis can be effectively decontaminated only using surgical access.[12] Karring *et al*.[39] demonstrated that, if a peri-implant pocket is deeper than 5 mm and has exposed implant threads, it cannot be decontaminated by submucosal debridement alone. There have been, however, no randomized control trials of the use of access flap surgery alone for the treatment of peri-implantitis.[33]

Resective surgical procedures with implantoplasty to reduce surface roughness and thereby decrease plaque formation has been suggested.

Peri-implant disease may have a positive effect on the survival rates of rough-surfaced implants affected by peri-implantitis.[40,41] Problems with this treatment modality include overheating of the implant fixture and possible embedding of titanium particles into the surrounding tissues, which could initiate an additional inflammatory response. Laser therapy shows promise as a treatment approach for peri-implant diseases because lasers are able to decontaminate the implant surface in a way which is unhindered by its irregular nature. Several *in vivo* studies have investigated the outcomes of treatment using the Er: YAG laser[35,42] and CO2 laser.[43] These studies show promising short-term findings. In their 10 years review of the literature, Peters *et al*.[44] highlighted the variation and inconsistency in the use of lasers to treat peri-implantitis. The type of laser, power setting, exposure time and distance are all variables, as is the combination of laser with other types of therapy. Further research is needed with longer follow-up times and standardized observation periods.

The cumulative interceptive supportive therapy protocol-proposed by Mombelli and Lang[45] and first used at the University of Berne was a strategy for both implant maintenance and treating peri-implant diseases. The principle is that of early detection followed by the interception with appropriate therapy. Regular recall with repeated assessment of the key parameters (plaque, BOP, suppuration, peri-implant pockets, and radiographic bone loss) forms the basis for this system.

CONCLUSION

Among the various etiological factors responsible for peri-implantitis the most significant factors causing peri-implantitis are the poor maintenance of oral hygiene, and low bone density, or low bone volume. A superadded systemic ailment such as diabetes mellitus and aggravating factors such as alcohol and smoking may be major contributory factors. Age and gender, however, showed no relevance.

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Source of support: Nil; Conflict of interest: None Declared