Failure of dental implants—An insight

Fahad Abdul Mohsen Fahad AlMarek¹, Sulaiman Al-Shammari²
¹ Department of Dental Public Health, Riyadh Colleges of Dentistry and Pharmacy, Riyadh
² Departments of Family and Community Medicine, King Saud University, Riyadh

Abstract: This report provides an update for dental professionals, factors associated with implant failure. Published articles on dental implant failure were searched by using various electronic data bases such as; Pubmed, Medline, Google Scholar, and Saudi Digital Library and relevant articles were collected reviewed critically. Many factors contribute to the failure of dental implants in clinical practice. Alveolar bone quality and volume markedly affect the implant failure rate. Hence careful evaluation of these factors should be carried out during the treatment planning in order to prevent possible dental implant failures.

Keywords: Alveolar crest, Implant, Failure, Factors.

Introduction
Dental Implants play significant role in modern dental practice by providing an opportunity to have fixed prostheses in compromised dentitions. Increasingly it is the more preferred choice by the clinicians to replace the non-treatable teeth by using dental implants. Many problems might be associated with conceded tooth requiring multidisciplinary approach of treatment. Substitute to missing or extracted tooth is the root-form implants that have been successfully placed for more than half a decade based on the titanium fittings that passes through alveolar mucosa into alveolar bone. Once the implant is osseointegrated, it is attached to a titanium abutment encircled by the alveolar mucosa.

The concept of osseointegration is the basis for dental implants functionality and success as replacements for natural teeth. Osseointegration can be defined as, “a process in which clinically asymptomatic rigid fixation of alloplastic materials is achieved and maintained in bone during functional loading”. It is first mediated by the deposition of proteins onto the implant [1]. In modern dentistry, osseointegration is the foundation for dental implant success. This can be problematic considering that the essence of osseointegration is a wound healing process. Thus, failure of proper healing may result in implant failure. Failing implant can be defined as the bone loss with pocket and purulence, bleeding upon probing, or evidence of continuing bone loss. Implant mobility is an indicator of the failure of the implant integration [2].

Hence the aim of this study is to critically review the factors associated with implant failure.

Method
This is not a systematic review; rather, to provide an update on the implant failure. We used results of meta-analyses and systematic reviews when available, and we supplemented these with comparative studies. For our overview MEDLINE, PubMed and Google Scholar for relevant English-language reviews and comparative studies published from January 1975 through March 2008 by using alveolar bone, peri-implantitis, implant failure, dental implant failure as key words.

Crestal bone loss
Data has suggested that nearly 3–4 hundred thousand endosseous implants were placed every year with general failure rate of 3%-8%. In addition, 1%-18% incidence of implant loss was observed after a follow-up period of 10 years. Patients with clinically well maintained implants have shown a crestal bone loss of 0.7mm-1.3mm after 10 years. [3]. In well osseointegrated endosteal implants crestal bone shows the initial breakdown at implant-tissue junction [4]-[6]. In case of single implants 95% of the failure occurred during the first year after placement [7].

Anatomic position
Significant differences existed in implant survival based on anatomic position in which implant is placed. Maximum survival rate (96%) of implant was observed in maxillary premolar area [7]. Many publications have reported an overall success rate of implants more than 95% and five year success rate of 98-99% in the lower anterior region [8]-[11]. Meta-analysis showed 93.6% the survival rate for implant supported fixed-partial-denture abutments after 6 years of function [12].

Implant types
Randomized clinical trials of systems with a follow-up period of at least 5 years of function reported no clinical differences among implant systems [13]. Similarly systematic review of 12 commercially pure titanium implant types showed no significant differences between various implant types in terms of failure rates [14]. Clinical studies have reported that machined implant surfaces have shown 20% lower chance of being affected by peri-implantitis than rough implant surfaces [13, p. 5].
The topic of immediate implant placement has generated a number of publications in the past few years. A meta-analysis and systematic analysis of the literature reviewed over 100 clinical trials using immediate or early loading [15]. Based on these analyses, it has been suggested that early loading with fixed prostheses in the anterior mandible is predictable irrespective of implant type, surface topography, or prosthesis design [16].

**Extraction site**

When placing implants in extraction sites, studies suggest that implant placement should be restricted to sites with no history of previous periodontal disease [17], [18]. It has been proposed that for immediate loading, implants should be not less than 10mm in length. Although there are numerous publications with immediate implant placement protocols, many questions are still remain unanswered due to the paucity of properly designed studies that would allow for definite conclusions [19].

**Smoking**

Smoking has been identified as a significant risk factor for implant failure [20]. Two factors particularly associated with increased failure rate of implants were found to be tobacco use and implant staging [21]. Predictors of implant failure were assessed in the posterior maxilla and it was found that smoking and surgical complications had a statistically significant effect on implant failure [22]. A significantly increased risk for developing peri-implantitis was observed among subjects with periodontitis associated tooth loss compared to tooth loss due to other factors [23].

**Role of bacteria**

Studies have shown that early implant failure was associated with the presence of serum antibody titers to T. forsythia, P. gingivalis and S. aureus [24].

**Sinus augmentation**

Sinus augmentation was not considered as a risk factor in retrospective study [25]. Wallace et al. reported that rough surface fixtures and membranes covering the osteotomy window improved implant survival following sinus augmentation. The percentage of bone-to-implant contact of roughened surface is approximately 41% in implants placed in sinus elevation [26].

**Occlusal overload**

Occlusal overload is considered a major cause of implant failure [18], [27]. Research has indicated that occlusal overload often resulted in marginal bone loss osseointegrated implants [18], [27]. Osseointegrated implants are in direct contact with surrounding bone and do not have a periodontal ligament, unlike teeth which has mechanoreceptors and a shock-absorbing function. Additionally, crestal bone surrounding the dental implants acts as a fulcrum point for a lever action when bending forces are applied. Therefore, dental implants are at more risk for crestal bone loss by mechanical force than natural teeth.

Several contributing factors included in the increased bending overload are prosthesis supported by one or two implants in the posterior region, increased crown/implant ratio, substantial deviation of the implant axis from the axial loading direction, increased cantilever length, mismatch in dimensions between the occlusal table and implant head, and parafunctional habits [27]. The cortical bone is known to be least resistant to shear force, which is considerably increased by bending overload [28]. Therefore, the above-mentioned factors might lead to progressive marginal bone loss or even de-osseointegration if the bending overloads increases beyond the threshold of bone homeostasis. It has been pointed out that occlusal overload could be a causative factor for implant failure, and both occlusal overload and peri-implant infection can result in progressive marginal bone loss [18]. On contrary study has shown that repeated mechanical trauma did not influence the peri-implant bone loss in healthy and diseased implant sites in experimental monkeys [29].

It has been suggested that constellation failures might occur in subjects with common profiles of risk factors such as poor nutrition, bone metabolic diseases, rheumatic diseases, and hormonal diseases, anomalies of neutrophil granulocytes, delayed hypersensitivity, immunological disorders and malabsorption syndromes [30], [31].

**Discussion**

One of our main goals is to provide information about some of the many causes and risk factors related to the failure of dental implants. Many factors linked with implants failure have been identified with loss of crestal bone after placement of an implant. These factors include: old age, bone quantity and quality, implant design, plaque deposition, tobacco use biologic width and biomechanical factors. Ensuring sterile conditions during implant placement were deemed important to reduce failure of osseointegration [18], [32]–[34]. This study reviewed studies published on the implants failure for a limited period of time. However, long term prospective studies have given tremendous information about the implant system success and failure.

Numerous systematic reviews were conducted to identify the factors affecting the failure of dental implants. But, systematic reviews are not always unambiguous. Systematic reviews are always open to interpretation and revision. Therefore, as the new evidence regarding the
implant failure accumulates it will change the conclusion of the review. There is not a single truth that once discovered will remain so forever. Science is always open to revision. These facts place significant demand on the clinician.

Conclusion

Many factors contribute to the failure of dental implants in clinical practice. Alveolar bone quality and volume markedly affect the implant failure rate. Hence careful evaluation of these factors should be carried out during the treatment planning in order to prevent possible failure of dental implants.

References


