Implant reconstructions in periodontally susceptible patients

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ABSTRACT Over the past few decades, dental implant treatment has become increasingly popular and is now a well-accepted option for the replacement of missing teeth yielding successful outcomes. Although favorable long-term outcomes from this procedure have been achieved in the general adult population, the success of dental implant treatment in periodontally susceptible patients was less clear. This article discusses implant reconstruction in periodontally susceptible patients, in relation to outcomes and periodontal care. Supportive care for implants and the management of biological complications in periodontally susceptible patients are also covered.

Key words: Dental implants; Periodontitis; Review; Survival

Introduction

Periodontal disease is the main chronic infectious disease of the oral cavity and a principal cause of tooth loss in humans. It involves inflammatory reactions which cause tissue destruction in tooth supporting structures, i.e. gingiva, cementum, periodontal ligament, and alveolar bone 1. There are different types of destructive periodontal diseases detailed in different classification systems, but chronic periodontitis is the most common form 2. In general, chronic periodontitis progresses slowly, and is characterized by bursts of disease activity, separated by quiescent periods 3. On the contrary, aggressive periodontitis progresses rapidly and relentlessly to periodontal destruction 4, and often commences during adolescence and early adulthood. Hence it was once classified as early-onset periodontal disease. Hong Kong can be regarded as a developed city with high-income earners and a well-developed dental care system. Yet surprisingly, epidemiological studies reveal that more than 50% of its inhabitants suffer from different degrees of periodontal destruction 5,6. If periodontal disease is left untreated, it inevitably leads to more attachment loss and increased mobility or even loss of teeth. Various studies 7-9 have already shown that the majority of tooth loss nowadays is due to periodontal disease. The consequence of tooth mobility and tooth loss somehow affects masticatory and speech functions, whilst esthetics may also be compromised by loss of anterior teeth. In addition, tooth loss without replacement and increased mobility of teeth has an adverse impact on the quality of life 10-12. Therefore, the dental profession must take on the responsibility of educating the public as well as patients about the prevention of periodontal disease, and the available options for managing it once it occurs.

Replacement of missing teeth is also an important part of the treatment strategy in patients with periodontal disease who have tooth loss. Since the introduction of osseointegrated implants, which were successfully used to serve as anchors for prosthetic reconstructions in fully edentulous patients 13, implants have been widely used to replace missing teeth in partially edentulous patients. It is also accepted that installation of dental implants is one of the treatment alternatives to fixed bridges or removable
partial dentures. Marketing estimates indicate that over 2 million implants were installed per year in the beginning of the 21st century and implant installation is expected to continue increasing over the next few years. Not surprisingly, installation of dental implants is expected to become a major clinical procedure in the reconstruction of dentition in the future, pursuant on accumulating clinical evidence and advances in technology. The favorable long-term prognosis of implant placement in the general population has shown it to be an effective and predictable treatment modality. However, available data on the performance of dental implant therapy in patients with periodontal disease are scarce, particularly after artificial teeth are placed in the environment of a contaminated oral cavity. Therefore, this article aimed to discuss implant reconstruction in patients with periodontal disorder, while focusing on the following aspects:

1. Outcome of implant therapy;
2. Considerations in periodontal patients before implant installation;
3. Difficulties encountered in relation to implant installation; and
4. Possible biological complications around dental implants, and their management.

Outcome of implant therapy in periodontal patients

Since the first report of successful dental implants was published, various studies and systematic reviews published over the ensuing decades have demonstrated this therapeutic modality to have predictable outcomes and high survival rates. In individuals with previous periodontal disease–associated tooth loss, recently there has been a debate as to whether the outcome of implant therapy is less successful and results in increased implant loss and biological complications, including peri-implantitis. Numerous studies have shown successful dental implant treatment in periodontitis-susceptible patients using different implant systems. A recent systematic review by Schou et al. tried to address whether previous tooth loss due to periodontitis increased the risk of implant complications. They performed a literature search and reviewed a large number of published articles; finally only two studies were included in their review. Exclusions were mostly due to: absence of control groups, fewer than 10 patients per trial, focus on aspects not related to implant treatment in periodontitis-associated tooth loss, and inclusion of patients with as well as without periodontitis-associated tooth loss. Although only two studies were finally included in this systematic review, the reviewers arrived at several conclusions about periodontitis-associated tooth loss. First, that significantly more individuals than controls were affected by peri-implantitis during the 10-year follow-up period; and second, that patients with periodontitis had significantly more peri-implant marginal bone loss after a 5-year follow-up. In addition, the authors of both studies indicated a significantly higher rate of biological complications, and lower long-term survival and success rates in patients receiving dental implants. Thus, although survival and success rates in periodontally susceptible patients are comparable to controls in the short term, long-term effects warrant careful consideration and assessment. Recently, Karoussis et al. comprehensively reviewed the outcome of implant treatment in periodontally compromised partially edentulous patients, based only on prospective studies; seven were short-term (<5 years) and eight long-term (≥5 years). The authors suggested that more long-term clinical trials should be conducted to assess corresponding effects more confidently, and that there should be an agreed definition of what was meant by ‘periodontally susceptible’. Although limited data were provided, conclusions from long-term studies suggested that pocket depths around dental implants in patients with chronic periodontitis tended to be more marked and a greater proportion of periodontally susceptible patients had deep pockets. Moreover, although their dental implants survived, they endured a higher incidence of peri-implantitis. It seems that these two recently published review articles, one highly selective and the other comprehensive, came to similar conclusions.

Another series of articles were recently published by Roos-Jansåker et al., who attempted to evaluate the long-term results of implant treatment retrospectively. Their studies entailed 999 implants (a large sample size), which were assessed both clinically and radiographically after 9-14 years. This series of observations provided valuable information on the behavior of these smooth surface implants in patients who were not enrolled in regular supportive care/maintenance programs. From their three reports it was concluded that: (1) a history of periodontitis seems to be related to implant loss; (2) after 10 years of use without systematic supportive treatment, peri-implant lesions are commonly found in titanium implants; and (3) individuals with a history of periodontitis and smokers are more likely to develop peri-implant lesions.

The findings and conclusions of the above-cited studies and reviews suggest that patients with a history
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of periodontal disease are more prone to peri-implant lesions and that peri-implantitis may share similar risk factors to periodontal disease. Accordingly, it is hardly surprising that higher complication rates may ensue from implant treatment carried out in periodontally susceptible patients who therefore warrant careful consideration before dental implant treatment, especially if missing teeth to be replaced were lost due to periodontal disease.

Considerations before implant installation

Link between periodontitis and peri-implantitis

The possible reasons for higher susceptibility to biological complications in periodontally susceptible patients are: (i) the bacterial plaque accumulation in partially edentulous dentitions, and (ii) the shared host response to the challenges from bacterial accumulation on teeth and implants. It is likely that after an extended period of time the presence of periodontitis-associated microorganisms-colonizing implant surfaces and surfaces of implant-borne restorations increase the risk of peri-implantitis. This is especially likely in individuals with a history of tooth loss due to periodontitis. Some studies report associations between periodontal and peri-implant tissue reactions to plaque accumulation, indicating the possible influence of existing periodontal status on peri-implant tissues. Microbiological studies have also demonstrated similar proportions of presumptive pathogens, both around implants and in periodontal pockets. In addition, the similarity of microbes found in association with both periodontitis and peri-implantitis is consistent with there being the same important etiological factors for both types of infection. It also seems that in such patients, residual periodontal pockets around periodontally involved teeth could act as reservoirs of infection for the development of peri-implantitis. Other risk factors which have been suggested include: specific genes and smoking tobacco. However, evidence for the existence of a genetic marker (such as interleukin-1 gene polymorphism) is limited, and no definitive conclusion about genetic susceptibility to peri-implantitis can be drawn as of now. Smoking is a confounding factor that confers a trend towards poorer implant survival rates, i.e. more implant loss, and more frequent biological complications.

Considerations for implant installation in periodontally susceptible patients

As it seems reasonable to assume an increased susceptibility to peri-implantitis in periodontally susceptible patients, it is advisable that the periodontal status of patients who are to receive implant should first be stabilized. The success of periodontal therapy and commitment to long-term supportive care by both the dentist and the patient are of utmost importance for the longevity of dental implants.

Table  Considerations when placing dental implants in periodontally susceptible patients

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<th>Before implant placement</th>
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<tr>
<td>1. Correctly screen/diagnose patients with susceptibility to periodontitis.</td>
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<td>2. Consider referral to a periodontal specialist/dentist with training in periodontology.</td>
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<td>3. Effectively treat and stabilize the periodontal condition (e.g. for full-mouth plaque score &lt;20%, full-mouth bleeding score &lt;25%, low percentage of residual probing pocket depths &gt;5 mm).</td>
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<td>4. Allowing up to 6 months to elapse for re-evaluation and to ensure the periodontal condition is stable and maintainable.</td>
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<td>5. The prognosis of periodontally involved, including already-treated teeth needs to be carefully assessed after active periodontal therapy.</td>
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<td>6. The risk profile must be established and the patient informed (e.g. smoking habit, history of periodontitis, diabetes mellitus).</td>
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<th>After implant installation</th>
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<td>1. Enrolment in a customized recall program (e.g. at 3-6 month intervals).</td>
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<td>2. Early detection of peri-implant complications by systematic and continuous monitoring of peri-implant tissues, including plaque assessment, presence or absence of bleeding on probing, suppuration on pressure or after probing, peri-implant probing depth changes relative to baseline and radiographic bone loss.</td>
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<td>3. Using a systematic approach for the prevention and treatment of peri-implantitis, e.g. Cumulative Interceptive Supportive Therapy (CIST).</td>
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<td>4. Advice from or referral to a periodontist should be initiated for any patient with peri-implant complications not responding to CIST.</td>
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installed in periodontally susceptible patients (Table). To evaluate the stability of the periodontal condition, mouth plaque and bleeding on probing should be minimized, so as to reduce the chance of disease recurrence. In patients with unstable and progressing periodontal sites, periodontal surgery should be considered as a means of eliminating or reducing residual probable pocket depths. Depending on different circumstances, a period of at least 3-6 months should elapse after active periodontal therapy before implant installation. This is to ensure that the periodontal condition is stable and that the patient is committed to sustained efforts at plaque control and a recall program for supportive care. If there is any doubt about a patient’s periodontal condition or response to active periodontal therapy, referral to a periodontist or dentist with higher education and training in periodontology should be arranged. In addition, a risk profile should be established before implant installation so that any increased liability to developing peri-implantitis that is identified is communicated to the clinician and patient. Other patient and local factors (compliance, smoking habit, systemic disease related to periodontal disease and/or increased risk from surgery; overall bleeding on probing; prevalence of residual deep pockets; furcation involvements) should also be considered. As peri-implant lesions developing after a period of time are common in patients not having systematic supportive care, the risk profile can also help the clinician set up a customized recall program to provide supportive periodontal care directed at maintaining periodontal and peri-implant health.

In periodontally susceptible patients, other recommendations can also be suggested, whenever implant installation is decided. First, complete-arch fixed partial dentures connecting teeth and implant abutments together can be used, so long as they have been evaluated in patients with normal and reduced periodontal support. Successful use of such implant-supported bridges joining teeth to implants has been demonstrated, provided rigid connectors are used. Although no definite conclusion can be drawn, as of now the use of rigid connectors in tooth-to-implant designs, as well as cross-arch stabilization approaches for splinting of teeth with reduced periodontal support are both indicated. They have scientifically proven to be successful in this group of patients. Second, replacement of teeth up to the first molar region i.e. 6 to 6 (Figures 1 and 2) could be considered to restore sufficient masticatory function, whenever the Shortened Dental Arch concept is incorporated. This will definitely reduce the risk of any complications whilst attempting to replace teeth in the second molar region.
Difficulties installing dental implants in periodontally susceptible patients

Implant installation in periodontally susceptible patients may be one of the most difficult clinical situations with regard to routine dental implant therapy for partially edentulous patients. Before the installation, a period of time should be spent to evaluate the success of periodontal therapy. Even if no residual periodontal problems remain, a patient’s poor oral hygiene practices and lack of compliance to keeping appointments has an unfavorable impact. In which case, deciding whether implant installation should be postponed, abandoned or proceeded with becomes difficult. Another challenge is to decide whether early extraction should be performed for periodontally involved teeth with a questionable prognosis. Questionable prognosis was classified by Becker et al. 41,42 as a tooth presenting with more than one of the following problems: (1) bone loss close to 50% of the root length; (2) probing depths of 6-8 mm; (3) class II furcation involvement with minimal inter-radicular space; (4) presence of a deep vertical groove on the palatal aspect of maxillary incisors, and (5) mesial furcation involvement of maxillary first bicuspid. However, the longevity of periodontally involved teeth with a questionable prognosis could generally be successfully maintained, provided proper periodontal treatment and long-term maintenance and follow-up are implemented 37,43. Therefore, for such individuals consultation with a periodontist should be considered before implant installation, and especially for those who want to keep their natural teeth, even though offering a prognosis is far from exact.

Limited bone volumes from alveolar bone loss due to periodontal disease also result in problems placing dental implants in periodontally susceptible patients, especially in the anterior regions. In our Chinese patient population, advanced gingival recession, narrow alveolar ridges (of reduced height and with thin gingival and mucosal tissues) are often encountered 44. Moreover, bony concavities are usually detected in the maxilla, resulting in improper and compromised positions of the dental implants. To overcome such situations, careful planning is necessary. This may involve using different methods to prepare the recipient sites. If there is insufficient bone for implant placement, successful outcomes may require: guided bone regeneration 45,46, split ridge techniques 47,48, and sinus lifting procedures 49,50. In addition, the use of reduced-diameter implants should also be considered. For periodontally susceptible patients presenting with deficient bone volume in horizontal aspects, successful outcomes have been achieved using these types of implants 51. However, implant fractures have been noted in periodontal disease–affected patients with some types of reduced diameter implants. In the regions of dentition that are of high esthetic concern, less-than-ideal results may have to be accepted, in which case the patient should be given a thorough and clear explanation before embarking on implant therapy. Loss of most maxillary incisor teeth through advanced periodontal disease results in considerable bone resorption and compromises implant therapy. Clinicians should also be aware that periodontally involved maxillary incisors may have already drifted to a class II division 1 relationship, making the correction of incisor alignment in the final restorations even more difficult. Insufficient vertical dimensions in maxillary posterior regions are commonly solved by the sinus lifting procedure. Either through a lateral window approach 52,53 or via a crestal access 54, elevation of the sinus floor has been reported to be predictably successful. A recent study showed the transalveolar osteotome technique to be a safe modality for treating the vertically resorbed posterior maxilla and has comparable success rates, provided sufficient residual bone height (6-9 mm in that study) is present 49.

Possible biological complications around dental implants and their management

Peri-implant diagnostic parameters

It is very important for clinicians performing implant installation to clearly appreciate the diagnostic parameters for monitoring peri-implant conditions. If a dentist has doubts about the peri-implant condition, advice from or referral to a periodontist should be initiated. Biological complications in association with dental implants include peri-implantitis—which has been defined as an inflammatory process affecting tissues around an osseointegrated functioning implant, entailing loss of supporting bone—and peri-implant mucositis. The latter has been defined as reversible inflammatory changes of the peri-implant soft tissues, without any bone loss around the integrated implant 54. Assessment of osseointegrated implants including both clinical and radiographic parameters is crucial for the evaluation of peri-implant tissue status. The important and most commonly used clinical parameters include the plaque assessment, presence or absence of bleeding on probing, suppuration on pressure or after probing, and peri-implant probing depths. Although reliable prognostic indicators for peri-implant hard and soft tissue changes...
are still lacking, systematic and continuous monitoring of peri-implant tissues includes peri-implant probing with periodontal probes (recommended for the early diagnosis of peri-implant disease).

Management of peri-implantitis

At present the prevalence of peri-implantitis is not really known, but its overall frequency around implants has been reported to range from 1-19%, depending on how it is defined. The prevalence might be up to 38% in periodontally susceptible patients. The wide ranges quoted in different studies seem to be due to the different definitions of peri-implantitis. In addition, more peri-implant complications have been noted recently, since dental implants have now been installed for longer periods of time. According to a systematic review by Klinge et al., there is still insufficient evidence to recommend any particular protocol for treating peri-implantitis effectively. Most of the studies on the management of peri-implant mucositis and peri-implantitis were in animals or case reports describing short-term clinical results. Most strategies incorporate anti-infective therapy with closed or open debridement/disinfection of the implant surfaces, using air powder or rubber cups as mechanical aids. Applications of citric acid, chlorhexidine or saline (chemical aids) were also used. Surgical treatment involves either resective or regenerative interventions. Using bone grafts and barrier membranes, one recent prospective cohort study using the regenerative approach appeared to show improved soft tissue conditions and bone filling around the implants. Thus, positive clinical results (resolution of inflammation, reduction of peri-implant probing depths and bone fill around the titanium implants) have been demonstrated, but long-term clinical data are lacking. To emphasize that ‘prevention is always
better than treatment’, high standards of oral hygiene should be established and maintained, while occlusal forces should also be regularly evaluated and adjusted when deemed to be traumatic. A systematic approach to prevention and treatment of peri-implantitis was suggested by Lang et al. 57. Those who perform implant therapy should become familiar with this protocol, which is called Cumulative Interceptive Supportive Therapy (CIST) [Figure 3]. Although not yet fully assessed, some publications suggest that it provides a useful approach to monitoring and managing peri-implant conditions. More ongoing prospective cohort studies are underway and further data on CIST can be expected in the near future 58,59.

Conclusion

In conclusion, implant reconstruction in periodontal patients has been shown to be a successful and predictable treatment option for the replacement of missing teeth due to tooth loss resulting from destructive periodontal disease 17,20,21,24. Some long-term studies have demonstrated a higher risk of peri-implantitis in this group of patients. Therefore, stabilizing the periodontal condition before implant installation is mandatory, and providing long-term supportive periodontal therapy is of utmost importance. This should include monitoring and managing both periodontal and peri-implant health, with a view to ensuring the best possible conditions for the long-term survival of the remaining dentition and dental implants.

References