Role of Dental Implant Superstructure in Patients with Severe Periodontal Disease

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Abstract

Many studies have investigated the relationship between periodontal disease and the onset of peri-implantitis. It is important to devise practical measures for preventing the development of peri-implantitis in patients with periodontal disease if the success of implant treatment is to be secured. Here, we report the role of the superstructure in two cases of implant treatment in patients with severe periodontal disease. Both patients had severe periodontitis and underwent implant treatment after improving the state of the disease, thereby ensuring that the implant superstructure could be maintained. Both cases remained stable after implant treatment. The results indicate that proper periodontal treatment prior to implant treatment leads to long-term success. In addition, it is necessary to use an implant superstructure that reduces plaque accumulation in preventing peri-implantitis.

Key words: Periodontal disease — Dental implant — Implant superstructure — Peri-implantitis

Introduction

Periodontal disease constitutes a potential threat to the success of dental implant treatment. Although basically an infectious disease, it is complex, and various factors play a role in its development. Therefore, it is important to establish the status and causes of this condition. In an earlier study by this group, the status of periodontitis was investigated in patients scheduled to undergo implant treatment, and the results revealed compromised periodontal tissue in most of the patients. An association has been reported between failure of implant treatment and infection by periodontal disease-related bacteria. This indicates that sufficient care should be taken to treat bacterial infection in residual natural teeth prior to implant treatment in patients with periodontal disease.

Planning is important when periodontal...
treatment is required in patients scheduled to undergo implant treatment. If the treatment plan is unsuitable, it is highly probable that implantation will be unsuccessful. Implant treatment should only be performed after improvement of oral hygiene and deep periodontal pockets. The type of periodontal treatment to be provided will depend on how far periodontal disease has progressed. Moreover, if disease is already severe, the treatment plan will have to provide for re-examination after completion of basic treatment.

When tooth extraction occurs due to periodontal disease, absorption of alveolar bone can be marked, the height of the prosthesis crown increase, esthetic properties worsen, and prosthetic material become surrounded by gum, making it difficult to clean. In such cases, much ingenuity is required to carefully clean the implant superstructure.

Here, we describe two cases of implant treatment in patients with severe periodontal disease. Informed consent was obtained from each patient for inclusion in this report.

Case Presentation 1

The patient was a 64-year-old woman who was referred to the Department of Oral and Maxillo-facial Implantology at Tokyo Dental College Chiba Hospital for dental implant treatment for missing maxillary and mandibular teeth. Many maxillary and mandibular teeth had been extracted due to periodontal disease 7 years previously. These had been replaced with a removable partial denture, which was only rarely used, however, due to discomfort. On her initial presentation at our department, periodontal disease was observed in the remaining teeth, together with gingival swelling. No systemic disease was present.

Intraoral visual examination at baseline revealed gingival inflammation and inaccuracy of dentition (Fig. 1). A more detailed intraoral and radiographic examination at baseline confirmed deep probing depth (PD) and marked alveolar bone resorption in most of the teeth (Figs. 2, 3).

An outline of the treatment process is...
shown in Table 1. Initial periodontal therapy consisted mainly of tooth brushing instruction (TBI), quadrant scaling, and root planing. Several teeth were extracted, and open flap debridement was performed for the remaining deep periodontal pockets. The original plan was to preserve the anterior mandibular teeth, but the mobility of these teeth could not be corrected, even after periodontal treatment, due to marked bone resorption. All the mandibular teeth were extracted. On completion of periodontal treatment, residual tooth PD was approximately 3 mm. All the maxillary teeth were connected and fixed using periodontal prostheses. Occlusion was also improved with a denture (Fig. 4). Two implants were placed in the maxilla and 6 in mandible (Fig. 5). Maxillary implants were fitted with a screw retaining-type superstructure, and mandibular implants with a fixed telescopic superstructure using an Auro Galvano Crown (AGC) (Fig. 6). The recall interval was set at 3 months, and at 8 years after implant treatment no problems had been observed (Figs. 7–9).

Case Presentation 2

The patient was a 57-year-old woman who was referred to the Department of Oral and Maxillo-facial Implantology at Tokyo Dental College Chiba Hospital. She hoped to regain the ability to bite and chew via dental implant treatment. Most of her teeth had been extracted due to periodontal disease 3 years previously. These were replaced with a removable partial denture at the time, but this had only rarely been used due to discomfort. On her initial visit to our department, all the remaining teeth exhibited signs of periodontal disease. Her medical history revealed sys-
temic disease, comprising hypertension, thyroid hypertrophy, and glaucoma. Visual examination at baseline revealed 7 remaining teeth and occlusal collapse (Fig. 10). A more detailed intraoral and radiographic examination at baseline confirmed deep PD and marked alveolar bone resorption in all teeth (Figs. 11, 12). An outline of the treatment process is shown in Table 2. Initial periodontal therapy consisted of TBI. Two teeth (#17 and #12) were extracted and the existing partial denture remodeled. Periodontal treatment was completed and occlusion improved using a refabricated treatment denture. Eight implants were subsequently placed in the maxilla and 6 in the mandible. When attaching the temporary implant superstructure in the maxilla and mandible, all remaining teeth

Table 1  Treatment process in case presentation 1

| Date          | Treatment                                                                                   |
|---------------|--------------------------------------------------------------------------------------------|
| June 2005     | Initial periodontal therapy                                                                  |
|               | · Plaque control                                                                            |
|               | · Quadrant scaling and root planing                                                          |
|               | · Root canal treatment (pulpectomy)                                                         |
|               | (14, 12, 11, 22, 23)                                                                        |
|               | · Tooth extraction                                                                           |
|               | (13, 24, 25, 26, 27, 31, 32, 33, 35, 41, 42, 43, 44, 45)                                     |
|               | · Provisional prosthesis                                                                    |
|               | (All teeth of maxilla are fixed prosthesis)                                                  |
|               | (Treatment denture)                                                                         |
| November 2005 | (Reevaluation)                                                                              |
|               | Periodontal surgical therapy                                                                |
|               | · Open flap debridement                                                                      |
|               | (14, 16, 17)                                                                                |
| January 2006  | (Reevaluation)                                                                              |
|               | Treatment for recovery of oral function                                                      |
|               | · Periodontal prosthesis                                                                    |
|               | (All teeth of maxilla are fixed prosthesis)                                                  |
|               | · Dental implant treatment                                                                  |
|               | (maxilla: 2 implants)                                                                       |
|               | (mandibular: 6 implants)                                                                    |
| March 2006    | (Reevaluation)                                                                              |
| to present    | Supportive Periodontal Therapy                                                              |
|               | · Oral hygiene instruction                                                                  |
|               | · Professional tooth cleaning                                                               |

Fig. 4  At end of periodontal therapy
Inflammation of periodontal tissue had disappeared and occlusion was stable with use of treatment denture.
were extracted. The maxillary and mandibular implants were fitted with a fixed telescopic superstructure using an AGC (Figs. 13, 14). As the implant superstructure was made of zirconia and porcelain, there was almost no plaque on recall maintenance. Therefore, there was no inflammation of peri-implant tissue in contrast with in the tissue surrounding the temporary superstructure (Figs. 15a, b). The recall interval was set at 3 months, and at 3 years after implant treatment no problems had been observed.

**Discussion**

Implant treatment in patients with periodontal disease offers many advantages, including avoidance of removable dentures, stability of occlusion, prevention of tooth grinding, and improvement of esthetics. The long-term prognosis in such cases is considered to be good if periodontal treatment is properly performed before implant treatment is started, and if maintenance includes good plaque control\(^8,17\). Aggressive periodontitis and severe periodontitis with systemic disease have a poor prognosis, however, so
special care must be taken in such cases if the success of implant treatment is to be secured. Implant treatment can increase susceptibility to disease progression. The role of genetic factors in the development of periodontal disease remains to be established so no treatment is yet available. It is possible, however, to address bacterial and environmental factors in this disease. Examination for periodontal pathogens is typically performed in such cases. Antibacterial therapy is then used to eliminate these pathogens prior to commencing implant treatment. This also acts to stabilize the remaining natural teeth and dental implants in the long term through the process of periodontal treatment and recall maintenance. It has been reported that periodontal disease patients are more susceptible to peri-implantitis, and that there was a significant difference when comparing peri-implantitis incidence rates between implant-treated patients with periodontitis and those who underwent tooth extraction for other reasons. Moreover, a microbiological study documented a correlation between failed implant therapy and periodontal pathogens. The onset mechanism for peri-implantitis is believed to be the same as that for periodontitis, as the same bacteria present in periodontal pockets are involved. Therefore, implant treatment in patients whose...
Periodontal disease has not been treated is thought to increase the risk of the development of peri-implantitis. With regard to systemic disease, risk factors such as diabetes, osteoporosis, and smoking, are generally managed or eliminated in cooperation with other medical departments. This approach has been very useful in dental implant treatment, particularly in cases of severe and/or aggressive periodontitis.

**Implant Superstructure**

| Upper | P | Buccal | 2 | 3 | 4 | 5 | 6 | 7 |
|-------|---|--------|---|---|---|---|---|---|
| Mobility | 0 | 0 | 0 | 0 | 0 | 0 |

| Lower | P | Lingual | 2 | 3 | 4 | 5 | 6 | 7 |
|-------|---|---------|---|---|---|---|---|---|
| Mobility | 1 | 1 | 1 | 1 | 1 | 1 |

Fig. 9  Periodontal examination after 8 years of maintenance in Case 1
Periodontal pocket depth in residual teeth was within 3 mm.

Fig. 10  Intraoral visual examination at baseline in Case 2
Most teeth were extracted due to severe periodontal disease.

Fig. 11  Radiographic examination at baseline in Case 2
Periodontal tissue around residual teeth showed significant bone resorption.

Periodontal disease has not been treated is thought to increase the risk of the development of peri-implantitis. With regard to systemic disease, risk factors such as diabetes, osteoporosis, and smoking, are generally managed or eliminated in cooperation with other medical departments. This approach has been very useful in dental implant treatment, particularly in cases of severe and/or aggressive periodontitis.

The implant superstructure to be used is often the fixed telescopic type\(^3\). This type of implant superstructure is cement-less and can
Fig. 12  Periodontal examination at baseline in Case 2
Deep periodontal pockets were observed in all teeth.

Table 2  Treatment process in case presentation 2

| Date            | Description                                      |
|-----------------|--------------------------------------------------|
| December 2010   | Initial periodontal therapy                      |
|                 | · Plaque control                                  |
|                 | · Tooth extraction                                |
|                 | (11, 12, 17, 22, 33, 38, 43)                     |
|                 | · Provisional prosthesis                         |
|                 | (Treatment denture)                              |
| June 2011       | (Reevaluation)                                   |
|                 | Treatment for recovery of oral function          |
|                 | · Dental implant treatment                        |
|                 | (maxilla: 8 implants)                            |
|                 | (mandibular: 6 implants)                         |
| March 2013      | (Reevaluation)                                   |
| to present      | Supportive Peri-implant Therapy                  |
|                 | · Oral hygiene instruction                       |
|                 | · Professional implant cleaning                  |

Fig. 13  Intraoral visual examination at end of treatment in Case 2
Fixed-type telescopic implant superstructure with zirconia frame.
easily be attached or detached. This means that it is possible to sufficiently prevent the accumulation of dental plaque by cleaning during recall maintenance. Here, no problems were observed after 8 years of maintenance in Case 1. In addition, by carefully devising the materials for the superstructure in Case 2, accumulation of plaque was reduced\textsuperscript{13,18}. Elimination of plaque accumulation on the implant superstructure can help prevent peri-implantitis.

**Conclusion**

Implant treatment in patients with periodontal disease is expected to become more common. Proper diagnosis and examination of periodontal disease and suitable treatment plans are necessary. By performing periodontal therapy according to such plans, it is possible to ensure the long-term success of implant treatment. In addition, it is necessary to use an implant superstructure that reduces the accumulation of plaque in order to prevent peri-implantitis.

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