Bone loss of relevance for implant placement in periodontitis patients

Björn Klinge, Anders Gustafsson, Margareta Hultin and Carlos Marcelo S. Figueredo

Treatment of patients with severe periodontal disease often involves complicated decisions concerning disease activity and prognosis of teeth with extensive attachment loss. Many factors, in addition to the periodontal status, contribute to the definitive treatment plan. The decision to extract or retain severely periodontally involved teeth is based on a combination of evaluating the disease activity, the prognosis, and the restorative possibilities of these teeth. The use of osseointegrated dental implants is a well documented and predictable method for treating edentulous or partially edentulous patients [1–7].

The possibility of an implant-anchored fixed bridge or an overdenture prosthesis has greatly improved the restorative alternatives in edentulous or partially edentulous patients. Even in patients treated for periodontal disease, restorative treatment with osseointegrated implants has been shown to be successful and predictable [8].

In some periodontal patients not responding to conventional periodontal therapy, the treatment scenario may also include a strategy of preserving alveolar bone of sufficient quality and volume for future implant placement.

Bone loss in untreated and treated periodontitis

Untreated periodontal disease results in progressive loss of the alveolar bone. Ellegaard et al. [9] found a mean annual bone loss of 0.2 mm on buccal surfaces and 0.3 mm on interproximal surfaces in periodontitis patients 40 years of age or younger. Becker et al. [10] studied the bone loss in 27 diagnosed but untreated patients (mean age 44.6 years) who were re-examined between 18 and 115 months after the initial examination. The

Authors
Björn Klinge, LDS, Odont Dr, Professor; Anders Gustafsson LDS, PhD; Margareta Hultin LDS; Carlos Marcelo S Figueredo LDS, MDSc; Department of Periodontology, Institute of Odontology, Karolinska Institutet, Stockholm, Sweden.

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study showed an overall average bone loss of 6.3% of the total tooth length. The bone loss was most pronounced at the molars, with a relative decrease in bone height between the baseline and the final examination of 19.8%, followed by the bicuspid (10.6%) and the anterior teeth (7.9%). Several longitudinal studies of untreated periodontitis indicate a random disease progression with bursts of destructive activity occurring with varying frequencies at various sites in certain individuals [10–11]. At individual sites it is therefore complicated to foresee the tissue response.

Long-term studies on the outcome of periodontal treatment show limited bone loss following periodontal therapy. Lindhe and Nyman [12] followed 61 patients with severe periodontitis who had been maintained for 14 years in a well-supervised maintenance care programme. The individual mean values of probing pocket depth, attachment level, and marginal bone height did not vary significantly over the 14 years of observation. However, some sites showed continuous bone loss despite maintenance and repeated therapy. The authors concluded that this site-specific bone loss is unpredictable and that individual means of probing depth and attachment level fail to disclose sites with recurrent disease. Goldman et al. [13] followed 211 patients treated for periodontal disease from 15 to 34 years and found that molar teeth were most prone to bone loss and that mandibular cuspids were most resistant to destructive bone loss.

Periodontally “hopeless” teeth

The influence of retained “hopeless” teeth on the proximal periodontium of adjacent teeth was evaluated by DeVore et al. [14]. Seventeen teeth, each mesially adjacent to one “hopeless” tooth, were evaluated for probing pocket depth and radiographic alveolar bone level. All teeth, both the “hopeless” and the adjacent teeth, received conventional periodontal treatment, including surgical therapy. The follow-up period of this study was 2–5 years. It was concluded that retained and treated “hopeless” teeth had no effect other than reduced probing pocket depth on the proximal adjacent periodontium, provided periodontal therapy was performed. Radiographic alveolar bone levels showed no significant differences between the initial and the final examination.

Proximal bone loss adjacent to periodontally “hopeless” teeth, with and without extraction, was studied by Machtei et al. [15]. Their retrospective study included 145 “hopeless” teeth with remaining adjacent teeth in 129 patients. The patients were pooled into two groups: group A consisted of 82 “hopeless” teeth which were retained throughout the study period, group B included 63 “hopeless” which were extracted at the commencement of the study. Teeth were considered “hopeless” if 50% or more of alveolar bone height had been lost at either of the sites proximal to the tooth or if radiography provided evidence of total bone loss in the furcation area of the tooth. The average follow-up period was 4 years. During the study period, no periodontal treatment was performed. Alveolar bone changes were measured as a percentage of the anatomic root length, i.e., from the radiographic apex to the cemento-enamel junction (CEJ). The retained “hopeless” teeth in group A showed progressive bone loss at a mean annual rate of 3.4% as
Bone resorption following tooth extraction

Following tooth extraction, the bony socket heals with normal trabecular bone. As part of the healing sequence, a subsequent resorption of the alveolar ridge can be observed (Figs 1 and 2). This residual ridge resorption (RRR) is most pronounced during the first year following extraction. The average RRR during the first year has been reported to be 4 mm in the mandible and 2 mm in the maxilla, while the additional annual long-term (10–25 years) resorption was 0.2 mm in the mandible and 0.07 mm in the maxilla [16]. Denissen et al. [17] proposed 4 stages of mandibular resorption. Even in cases of severe periodontitis with extensive loss of bone height, the remaining teeth seem to prevent resorption of the width of the mandible. The loss of bone height is most extensive in the anterior region of both jaws. Tallgren [16] found an average loss of anterior mandibular bone height after 25 years amounting to 13 mm; the corresponding value in the maxilla was 5 mm.

A number of studies suggest a correlation between alveolar atrophy and metabolic factors such as osteoporosis [18–20]. It also has been suggested that the gonion index, i.e. the cortical thickness at the gonion reference point, could be used as an indicator of bone resorption. A gonion index of less than 1 mm indicates an on-going metabolic bone loss [20]. However, not all RRR can be explained by systemic factors. Some of the resorptive activity, especially the resorption taking place just after a tooth extraction, seems to be influenced by a local biochemical inheritance from the dentate period. Other factors affecting the speed and extent of RRR are original bone volume, muscle function and extraction history. The duration of edentulousness also seems to be an important factor for RRR [20].

One aspect in the treatment of patients with severe periodontitis may relate to the question of whether the extensive initial residual RRR following tooth extraction when the tooth is extracted with most of the bone height remaining or if this response is different if the tooth is extracted after extensive bone loss. We have not been able to find any conclusive answer to this question in the literature. Until conclusive studies exist, it is reasonable to assume that the local biochemical inheritance from the dentate period is the same regardless of the attachment level of the extracted tooth.

Periodontitis as a prognostic factor for implant treatment

There are only a few studies evaluating the long-term survival and prognosis of oral implants inserted in periodontally compromised partially edentulous patients [9, 21].

Nevins and Langer [21] report on the successful use of 309 implants placed in 59 patients treated for advanced periodontitis. A success rate of 98% was demonstrated. Of the 309 implants placed, only four mandibular and three maxillary implants failed.

Ellegaard et al. [9] evaluated the outcome of implant therapy in periodontally compromised patients. A total of 124 implants in 75 partially edentulous patients was observed during 3–84 months; 3 implants failed, yielding a 3-year survival rate of 95%. After 3 years, 76%–86% of all implants remained free from radiographic bone loss >1.5 mm. These results indicate that periodontally compromised patients who have experienced a considerable loss of alveolar bone support can be successfully treated with implants.

Conclusions

Studies of the retention of periodontally severely damaged teeth show that untreated periodontal lesions also give rise to continuous bone loss at neighbouring teeth. In contrast, the retention of treated “hopeless” teeth does not cause any increased bone loss at adjacent teeth. This means that “hopeless” – but strategically important – teeth can be retained without risk of losing bone height for future implants, provided that they are carefully treated and maintained.

Long-term studies show that periodontal therapy with careful maintenance is successful and predictable on an individual level and that the average bone loss is not worse in patients treated for periodontitis than in edentulous patients. Some sites will show a continuous deterioration in spite of active treatment and a careful maintenance programme. These sites are very difficult to predict by evaluating clinical parameters such as probing pocket depth and bleeding on probing. This indicates that it is dubious to extract still functioning teeth to save bone height for future implants. It is reasonable to believe that single-rooted “hopeless” teeth have the best periodontal prognosis, making strategic extractions in these areas suitable for later implant placement even more dubious. Additional studies are needed to
guide us in clinical decision-making of whether to save or to extract teeth to preserve bone for future implant placement.

Summary

Treatment of severe periodontitis may involve complicated decisions concerning extraction or retention of severely compromised teeth. The possibility of using dental implants in the rehabilitation of patients treated for periodontal disease raise the question whether to keep or extract "hopeless" but strategically important teeth, in order to prevent additional bone loss. Untreated periodontitis seems to have a random progression, where it is difficult to foresee the tissue response at individual sites. In the absence of periodontal treatment, the retention of "hopeless" teeth can cause bone loss at adjacent teeth. On the other hand, tooth extraction is normally followed by resorption of the alveolar ridge. Periodontal therapy with careful maintenance is, however, successful and predictable at an individual level and the average bone loss is not worse than in edentulous patients, with the exception of few sites that may show a continuous deterioration. This means that "hopeless", but strategically important teeth, can be retained with a very low risk of loosing bone height for future implants, provided that they are carefully treated and maintained. Additional studies are needed to guide us in the decision of saving or extracting teeth to preserve bone for future implant placement.

References


Address

Björn Klinge, Department of Periodontology, Institute of Odontology, Karolinska Institutet, P. O. Box 4064, SE-141 04 Huddinge, Sweden.