Long-Term Success in Dental Implant Revisions: A 31-Year Case Study of Alveolar Atrophy Management in an Elderly Woman

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Patient: Female, 56-year-old
Final Diagnosis: Edentulism • improvement of functional and esthetic
Symptoms: Edentulism
Clinical Procedure: Dental implants
Specialty: Dentistry

Objective: Unusual clinical course

Background: In the early 1980s, Brånemark described the use of cylindrical titanium dental implants integrated with bone. Since then, significant advances in dental implant technology have resulted in improved function and cosmetic appearance. This report describes an 87-year-old woman with a 31-year history of revision implant dentistry, initially for severe alveolar atrophy of the premolar and upper molar teeth.

Case Report: In 1992, a severe alveolar atrophy of the upper premolar and molar areas was treated with the insertion of 4 fixtures in the frontal sector and a prosthesis superimposed anchored to the fixtures and with a rear support on the only surviving teeth. In 2004, the teeth were extracted and a distal support to the prosthesis was obtained with 2 fixtures in the maxillary tuberosity. In 2018, to eliminate the need for home removal of the prosthesis, 2 zygomatic fixtures were positioned and a fixed prosthesis was made. In 2023, at the last follow-up, satisfactory function and aesthetics of the prosthesis were reported and the bone levels at the fixtures appeared stable.

Conclusions: This report demonstrates the improvements in dental implant technology over more than 30 years in a single patient and highlights the importance of improved function and cosmetic appearance.

Keywords: Dental Implants • Dental Prosthesis Design • Patient Satisfaction

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Introduction

Brånemark’s technique for dental implantology is based on the insertion of screw-shaped titanium implants directly into the jaw bones, with minimal tissue injury. After a variable healing period, these implants are integrated with a direct connection to living bone without any intermediate tissue (osseointegration). Therefore, dental prostheses can be connected to the implants, using various kinds of abutments. The osseointegration process allows the prosthetic load to be transferred directly to the bone [1,2].

Although the titanium implant described by Brånemark et al. in Sweden was certainly the first well-defined report with long clinical follow-up [1,2], an important contribution, especially in deepening the relationship between titanium and biological tissues, was provided by Schroeder et al in Switzerland [3]. The 2 groups of researchers agreed on the surgical principles (low-trauma surgery, avoid overheating of the bone, seeking primary stability, and waiting 3-6 months before functional loading), but they differed on the characteristics of the implant and its positioning with respect to the ridge bone [4,5].

In the 1980s, the Brånemark team continued to use a screw-type implants with moderately smooth machined surfaces and adopted submerged implant placement [2]. Schroeder’s team, which constituted the first nucleus of the International Team for Implantology (ITI), instead proposed and used different forms of implants (generally 1-piece implants) with a titanium plasma-sprayed surface (quite rough and microporous) and non-submerged and transmucosal positioning [5]. Subsequently, Albrektsson et al. (1986) [6] confirmed the validity of the threaded solid screw-type implant, and Sutter et al. (1988) [7] marked the transition of the ITI from the 1-piece implant to a 2-piece implant with various abutments, while maintaining the concept of a non-submerged tissue-level implant. Thus, the 2 large implant families were defined that still characterize oral implantology today.

In the 1990s, the expansion of the indications of implant dentistry to single and partial edentulism and the development of guided bone regeneration techniques made oral implant placement the most common and well-standardized therapeutic option in dentistry and led to an increase in demand for good esthetic outcomes, not just function alone [5]. The observations of Buser et al. (1991) [8] on the influence of the implant surface on bone apposition and on the increase in the removal torque value with rough surface, however, opened a wide debate and gave impetus to studies on new surface treatments, which are generally defined as moderately rough and which currently are the first choice of most implant companies [9]. In the same years, another cornerstone of implant dentistry was called into question – the waiting times before functional loading were subjected to revision. Clinical studies with long follow-ups and clinical review [10] confirmed the reliability of immediate loading and, subsequently, the parameters that we still consider valid today were defined [11].

At the turn of the 21st century, the high standard of implants on the market and the increased use of computed tomography shifted the focus of research and clinical analysis to the esthetic result and optimization of surgical-prosthetic times [5]. The observation of the advantages of platform-switching [12] and the association of the latter with the quality of the peri-implant soft tissues [13] led to greater attention in the selection of cases and in the analysis of local risk factors. In particular, the need to preserve post-extraction bone volumes led to a new definition of surgical times and socket preservation techniques [14]. This clinical area will then be subject to constant updates [15].

Over the last 2 decades, the impressive development and diffusion of digital dentistry has allowed the introduction of increasingly refined workflows in both surgery and implant prosthetics [5]. The standardization of zygomatic implantology, introduced in the 1990s [16], has made it possible to address and resolve even the most serious atrophies of the upper jaw in a predictable manner [17,18]. This report describes an 87-year-old woman with a 31-year history of revision implant dentistry, initially for severe alveolar atrophy of the premolar and upper molar teeth.

Case Report

In February 1992, a 56-year-old woman in good health presented to us with extensive removable prostheses in both arches that were never well tolerated (Figure 1A). She requested a fixed prosthesis or at least a prosthesis that was as stable as possible. The upper removable prosthesis had a clasp anchorage on teeth 16 and 27. The lower prosthesis was a skeletal removable prosthesis with extracoronal attachments on teeth 35 and 44. Clinically and radiographically, the severe bone resorption of the edentulous areas, both vertical and horizontal, was evident and superiorly this was associated with a wide pneumatization of the maxillary sinuses (Figures 1B, 2).

The severe alveolar atrophy of the premolar and upper molar areas, together with the pneumatization of the maxillary sinuses, allowed the insertion of fixtures (Brånemark System) only in the frontal sector. The residual vertical bone diameter required use of shorter implant (3.75×7 mm) in regions 12 and 22. In regions 13 and 23, fixtures of 3.75×10 mm were positioned. To ensure distal support, the periodontal state of teeth 16 and 27 was improved, and 2 double crowns were made. This allowed the construction of a polymethylmethacrylate (PMMA) prosthesis superimposed on an Ackermann bar.

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Figure 1. Clinical findings at the presentation. Intraoral view with (A) and without (B) removable prostheses. The upper prosthesis had a clasp anchorage on only surviving teeth (16 and 27). The lower skeletal prosthesis had attachments on distal teeth (35 and 44). Resorption of the alveolar ridges was evident.

Figure 2. Radiographic findings at the presentation. A severe bone resorption of the edentulous areas was evident. The maxillary sinuses showed extensive pneumatization.

Figure 3. Upper rehabilitation through tooth-implant-supported prosthesis with double crowns on surviving teeth (16 and 27).
(A) Intraoral view. An Ackermann bar was anchored to 4 frontal implants and 2 crowns were positioned on the teeth.
(B) Prosthetic components: polymethylmethacrylate (PMMA) superimposed prosthesis with double crowns, Ackermann bar and crowns.
(anchored to the implants) with rear support on the double crowns of teeth 16 and 27 (Figure 3A, 3B).

The edentulous areas of the mandible were treated with the insertion of 4 implants (Brånemark System) in areas 36, 34, 45, and 46. The bone diameters available only allowed implants of 3.75×7 mm in areas 36, 45, and 46. In area 34, it was possible to use a 3.75×13 mm implant. The implants positioned allowed the use of a metal-ceramic fixed prosthesis with mixed tooth-implant support in both premolar and molar areas (Figure 4A-4D). The mixed support was used to remedy the reduced implant length and the non-optimal periodontal state of teeth 35 and 44 (support of the previous removable prosthesis). To minimize the disadvantages of mixed support on such pillars, the connection between teeth and implants was designed with a rigid vertical constraint only in the apico-coronal direction (B). Thus, the physiological intrusion of the tooth during chewing was not hindered by the rigidity of the implants.

Both prostheses allowed sufficient function and esthetics and considerably reduced the patient’s discomfort (Figure 5A, 5B). The subsequent follow-up showed good stability, maintenance of the bone levels in correspondence with the implants, and good patient satisfaction.

In February 2004, the periodontal state of teeth 16 and 27 could no longer ensure sufficient distal support for the upper prosthesis. Therefore, teeth 16 and 27 were extracted. To restore the distal support to the upper prosthesis, 2 implants (Astra Tech Implants), 4×9.5 mm and 4×11 mm on the right and left, respectively, were inserted, in correspondence with the maxillary tuberosity (the only area with sufficient bone volume) (Figure 6). The upper prosthesis was modified and kept superimposed.

In October 2018, home maintenance of the distal upper implants became increasingly complex for the patient, and episodes of peri-implant inflammation were reported. Moreover, the patient expressed a strong desire for a readjustment of
the upper prosthesis, eliminating, above all, the need for home removal of the same. Therefore, 2 zygomatic implants (IDC) were inserted in areas 15 (4.2×50 mm) and 25 (4.2×50 mm) and a fixed prosthesis (Cr-Co framework with ceramic coating) was made anchored to the latter and to the surviving anterior implants (Figure 7A-7D). The implants in the tuberosity region were excluded from the prosthesis, but left in place. In February 2023, the last follow-up showed satisfactory function and esthetics (Figure 8A), and the bone levels at the implants also appeared stable (Figure 8B). Finally, the main goal was the complete satisfaction of this patient in her 90s.

Discussion

The possibility of having long follow-up allows us to observe and analyze the numerous changes that have occurred in implant dentistry and to better understand the steps that led to the current state of the art. The possibility of examining a path lasting more than 30 years in a single patient is not common. At presentation in 1992, the patient arrived with a subtotal edentulism of the upper jaw, significant bone atrophy (Figures 1, 2) and an explicit and heartfelt request for a stable prosthesis. At the beginning of the 1990s, implant dentistry, although relatively new, was already a reality consolidated by long-term follow-up studies, especially in edentulous jaws [19]. Therefore, the choice of a prosthesis superimposed on an Ackermann bar anchored to the implants appeared absolutely in tune with the state of the art of the moment. The choice to also involve teeth for prosthetic support and to use double crowns was not unusual [20,21]. In subsequent years, most clinicians agreed that the use of removable or fixed tooth-implant-supported prosthesis should be limited to cases in which the anatomy or precise choices of the patient do not allow a conventional treatment solely supported by teeth or free-standing implants [22,23].

Readjustment of the upper prosthesis was made necessary in 2004 by the patient’s declining dental health. The absence of significant complications and/or need for prosthetic
Figure 7. Clinical findings after second prosthetic readjustment. (A) Intraoral view of the upper jaw with all implants: the 4 frontal implants were positioned 26 years before; the distal implants (in maxillary tuberosity) were positioned 14 years before; the middle implants (zygomatic implants) were positioned several weeks before. The picture was taken at the end of soft tissue healing. The surgical incisions for the placement of the 2 zygomatic implants are still evident on both sides. (B) Intraoral view of the upper jaw with screwed prosthetic bar. Distal implants were excluded to reduce unnecessary extension and to allow simpler home hygiene. (C) Intraoral view of upper fixed implant-supported prosthesis. (D) Upper prosthesis before mounting in the mouth. Six implants were involved in supporting. A functional but reduced cantilever was carried out.

Figure 8. Five-year follow-up after last readjustment. Clinical (A) and radiographic (B) findings. The cosmetic appearance of the upper prosthesis was acceptable. The marginal bone level appeared generally preserved. Using unloaded distal implants may be unnecessary given that the prostheses (upper and lower) have a suitable “length” even without use of the upper distal implants. The distal unloaded implants did not interfere with function.
readjustments up to that point (after 12 years) was a surprising clinical result. Only subsequent long-term clinical follow-up studies would have demonstrated that the implant-prosthetic solutions adopted do not have significant complications and usually do not require a change in the type of prosthesis [24]. To maintain a distal support for the upper prosthesis, the teeth, now periodontally compromised, were “replaced” by 2 implants in the maxillary tuberosity and the existing prosthesis was appropriately modified. At the time, the use of the maxillary tuberosity, although not frequent, had already been described several times and was therefore considered an adequate option [25,26].

The subsequent readjustment also came after a long period (in 2018, after 14 years) and was determined by the patient’s request to make the upper prosthesis fixed and less voluminous. The clinical status of the implants was satisfactory and possible variables were analyzed [27]. Although the implants positioned in the maxillary tuberosity were considered a valid solution for full-arch fixed prostheses [28,29], it was decided to exclude them from the new solution as they would have required a distal extension not necessary for chewing and created difficulties in home hygiene due to the patient’s reduced manual abilities. Hypotheses of bone regeneration were excluded because it was considered more invasive, less predictable, and did not satisfy the patient’s wishes in relation to waiting times [30]. Therefore, to obtain distal support, 2 posterior tilted implants were positioned [31,32]. The resulting cantilever was deemed acceptable [33].

The 5-year follow-up after the last prosthetic readjustment showed good function and acceptable esthetics, with complete patient satisfaction.

Conclusions

This report demonstrates the improvements in dental implant technology over more than 30 years in a single patient. These improvements have allowed achievement of increasingly ambitious clinical results in terms of predictability and duration, with increasingly natural and satisfying esthetic results for the patient.

Department and Institution Where Work Was Done

The work was done at “Carlo Piccoli” Private Dental Clinic, Verona, Italy.

Declaration of Figures’ Authenticity

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