An Investigation of 131 Consecutively Placed Wide Screw-Vent Implants

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Between February 1995 and May 1996, 71 patients received treatment that involved 1 or more wide Screw-Vent implants. A total of 131 wide implants were placed. All patients were recalled 1 year after loading. Seven patients (14 implants) were lost to follow-up. Six implants were removed before completion of prosthetic treatment. One hundred eleven implants were evaluated at the recall examination. Almost all implants (109) supported a fixed prosthesis; in the majority of patients (93 implants), it was a fixed partial prosthesis. The mean loading time was 17 months (range, 11 to 21 months). No implants were lost during the loading period. The overall survival rate was 95%. The survival rate for mandibular implants was 94%; for maxillary implants, it was 96%. These percentages were not statistically different. Crestal bone remodeling was examined using periapical radiographs. After 17 months in function, only 3 implants (2.5%) presented bone loss beyond the first thread. (INT J ORAL MAXILLOFAC IMPLANTS 2001;16:827–832)

Key words: *crestal bone resorption, endosseous dental implants, wide-diameter implants*

Wide screw-type endosseous implants (more than 4.5 mm at the thread level) have been introduced into clinical practice in the last several years.[1] They provide a greater interface with supporting bone,[1,2] are 3 to 6 times stronger than standard implants,[3] and reduce the risk of screw fracture.[1,4] When prosthetic components match the increased diameter of the implant, they may also lead to better esthetics, optimal emergence profiles, and improved oral hygiene.[1,5] Initially used as rescue implants,[2] wide screw-type implants have become the first choice in clinical situations such as extraction sites, poor-quality bone, limited crestal height, bruxing patients, and cantilevers.[1,5–7]

Several short-term studies on wide implants have been published, demonstrating favorable survival rates (94% to 98%).[1,6,8] However, several authors[9–14] have reported less optimistic results. Langer[2] stated that 75% to 87% success rates were obtained in a 3-year multicenter study. Another team[10] reported a 1-year success rate of 88% with 84 implants. The following year, this success rate dropped to 85%. The same authors later reported their 4-year results after including another 236 wide implants[11]; their success rate rose to 89%. In 2 other studies, the use of wide implants led to increased failure rates versus standard implants.[12,13] Wide implants have been associated with increased cervical bone resorption and exposed threads when compared to standard implants.[14]

The purpose of this clinical study was to determine survival rates of wide Screw-Vent implants (Paragon, Encino, CA) and to evaluate marginal bone loss around these implants at least 1 year after completion of the prosthetic treatment.

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MATERIALS AND METHODS

Patient Selection

All patients who consecutively received 1 or more 4.7-mm-wide Screw-Vent implants (Paragon) between February 1995 and May 1996 were included in this study. Exclusion criteria included general pathologies that would contraindicate

Table 1 Distribution of Wide Implants According to Prosthesis Type

Prostheses	No. of implants		
	Maxilla	Mandible	Total
Fixed			
Total	2	1	3	4
Partial	61	44	49	93
Single	12	2	10	12
Removable	2	2	0	2
Total	77	49	62	111

Several wide implants were associated with standard or narrow implants in the same prosthesis.

implant treatment, insufficient bone height, insufficient interarch space, and lack of buccolingual (< 6.5 mm) or mesiodistal space.

The total number of patients was 71. They were followed for a mean of 17 months (range, 11 to 21 months) after completion of prosthetic treatment. The total number of 4.7-mm-wide implants placed was 131. In a few patients, these implants were associated in the same prosthesis with standard-diameter (3.7-mm) or narrow-diameter (3.3-mm) implants.

Introduced in 1995, the wide implants used in this study were threaded, self-tapping, acid-etched, uncoated titanium alloy implants. The diameter of the threaded portion is 4.7 mm, and the 0.6 mm distance between each thread (pitch) is the same as that of the standard Screw-Vent and Brånemark System implants (Nobel Biocare AB, Göteborg, Sweden). The neck of the implant is 4.5 mm wide and the first thread starts after a 2.5-mm collar. At this stage, there have been no publications on the clinical outcomes regarding the use of this wide implant.

Stage I Surgery

An orthopantomogram and, in most cases, a computed tomographic scan were used in planning implant positioning. For the majority of patients, surgical templates were fabricated to guide implant placement. All implants were placed in a private dental practice setting under local anesthesia. A single surgeon was responsible for the implant placement and uncovering procedures. Oral antibiotics were prescribed routinely as a prophylactic measure (amoxycillin, 2 g/day for 6 days). Patients were instructed to rinse with chlorhexidine digluconate (0.12%). To avoid any overloading during the healing period, existing removable prostheses were relieved.

Stage II Surgery

Uncovering of the implants normally was performed 3 to 6 months after stage I surgery, depending on implant location and bone quality. Depending on the patient's availability, stage II surgery was performed a few days earlier or later than the prescribed date. The mean interval between stage I and stage II surgeries was 4 months and 6 days for the mandible and 5 months and 8 days for the maxilla. Based on mucosal dimensions, different lengths of temporary healing abutments were used. Ninety-one implants (78%) were placed using this conventional protocol, but 26 (22%) received their healing abutment at stage I surgery and were therefore left nonsubmerged during the healing period. This method has been presented as an acceptable alternative by several authors.[15,16] In the present study, only implants placed in dense bone with no existing removable prostheses were considered for this nonsubmerged protocol.

Prosthetic Treatment

Six implants were removed before loading. Among the 6 removed implants, 4 had been placed submerged and 2 nonsubmerged. Seventy-seven prostheses were fabricated on the remaining 111 implants. Nine general practitioners and prosthodontists were involved in this treatment. Thirty-three prostheses (49 implants) were placed in the maxilla and 44 (62 implants) in the mandible; 75 prostheses (109 implants) were fixed and only 2 (2 implants) were removable (Table 1). In several patients, wide implants were combined with standard or narrow implants in the same prosthesis.

Of the completed fixed prostheses:

- Two (4 wide implants) were complete-arch fixed prostheses; 1 (1 wide implant) was in the maxilla and 1 (3 wide implants) was in the mandible.
- Sixty-one (93 wide implants) were fixed partial prostheses; 28 (44 wide implants) were in the maxilla and 33 (49 wide implants) were in the mandible.
- Twelve implants supported single-tooth restorations; 2 wide implants were in the maxilla and 10 wide implants were in the mandible.

In most patients, abutment selection was made on the master cast. Selection depended on implant angulation, available interarch space, and the desire to facilitate retrievability with screw-retained prostheses or to favor esthetics with cemented restorations.

Porcelain was used most often on the occlusal surfaces of the fixed prostheses. A few prostheses were fabricated using other materials, such as

acrylic resin or precious or nonprecious metal alloys. The prostheses that received acrylic resin on the occlusal surface were fixed detachable restorations fabricated with denture teeth according to the Swedish protocol.[17]

Implant Evaluation

An evaluation form was designed for this study. It provided information on the clinical variables under study.

Mobility. As in other clinical studies,[17,18] it was decided to not routinely remove the fixed prostheses to test for mobility, if all other clinical parameters were satisfactory. If a screw-retained prosthesis was removed for maintenance at the recall appointment (for cleaning of the prosthesis or the abutments or for checking the abutment screws), the implants were tested for mobility. Cemented prostheses were removed only if access to the substructure was needed (ie, tightening an abutment screw). Any fixed prosthesis that showed the slightest mobility was removed and the implants were examined. Any implant that presented the slightest detectable mobility or persistent pain was considered a failure and removed.

Crestal Bone Resorption. Periapical radiographs were obtained at the annual recall appointment. All of these radiographs were made using Rinn angulators (Rinn, Elgin, IL). Sometimes, this technique provided images on which it was impossible to visualize the apex of the implant. This was considered acceptable if at least 5 threads of the implant were visible and if bone resorption in the cervical portion of the implant could be adequately assessed. Even when available, panoramic radiographs were never used to assess bone loss.

Observations were made with a special magnifying device (X-Produkter, Malmö, Sweden). The lowest observed point of crestal bone in intimate contact with the implant (CBC) was identified both mesially and distally for each implant. All implants presenting with a mesial and distal CBC above the first thread were considered normal (Fig 1). The other implants were set aside for further evaluation of crestal bone loss.

Patient Recall

All patients were contacted 1 year after completion of the prosthetic treatment. Seven patients (9.8%) could not be recalled (14 implants). They were considered lost to follow-up and excluded from the study. One died, and 6 lived far from the office (Israel, Ivory Coast, West Indies, and Tunisia). These 6 patients reported that their implant restorations were functioning well.

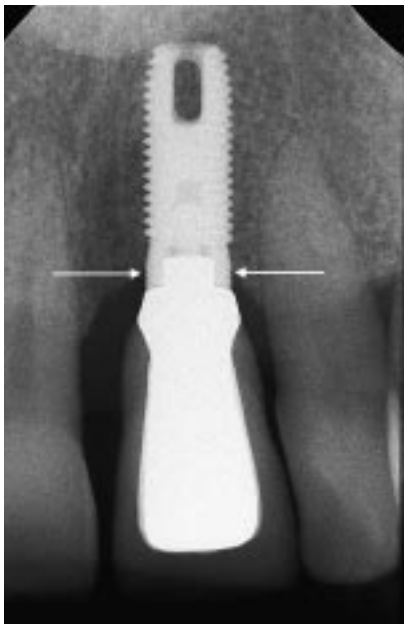

Fig 1 Wide Screw-Vent implant (4.7 mm diameter) placed in the maxillary anterior region; 97.5% of the evaluated implants did not show bone resorption beyond the first thread after a mean loading time of 17 months (range, 11 to 21 months). Arrows indicate mesial and distal CBC level.

Of the 64 patients recalled, 32 (50%) were men and 32 (50%) were women. The patient population varied from 17 to 78 years of age, with a mean of 57.8 years. One hundred seventeen implants of the 131 implants placed (90%) were evaluated in this study, 66 (56%) in the mandible and 51 (44%) in the maxilla.

RESULTS

Survival Rate

In all instances, observation time was calculated from the time of completion of prosthetic treatment to the time of the last recall. Observation time varied between 11 and 21 months. The mean was 17 months (1 year and 5 months).

The number of dropouts, failures, and surviving implants is shown in Table 2. Six of the 117 implants were considered failures. No mobility, pain, swelling, nor suppuration were associated with the 111 surviving loaded implants. The survival rate was 95%. Implant survival rates according to type of treatment are shown in Table 2. Survival rates according to implant location and length appear in Table 3.

Four implants failed in the mandible and 2 failed in the maxilla. The survival rate for mandibular implants was 94%, and that for maxillary implants

Table 2 Distribution of Implant Survival Rates, Dropouts, and Failures According to Type of Treatment

	Maxillary implants	Survival rate	Mandibular implants	Survival rate	Total	Overall survival rate
Implants placed	55	—	76	—	131	—
Recalled implants	51 (2)	96%	66 (4)	94%	117 (6)	95%
Totally edentulous fixed (failed)	1 (0)	100%	4 (1)	75%	5 (1)	80%
Partially edentulous fixed (failed)	44 (0)	96%	52 (3)	75%	98 (5)	94%
Single tooth (failed)	2 (0)	100%	10 (0)	100%	12 (0)	100%
Removable denture (failed)	2 (0)	100%	0 (0)	—	2 (0)	100%
Tooth survival rate	—	96%	—	94%	—	95%

Table 3 Implant Survival Rates and Failures According to Implant Length and Location

Location/ implant length	Maxilla (failed)	Mandible (failed)	Total (failed)	Survival rate (%)
Molar				
8 mm	14 (1)	10 (1)	24 (2)	92
10 mm	1 (0)	28 (3)	29 (3)	90
13 mm	4 (0)	11 (0)	15 (0)	100
16 mm	5 (0)	2 (0)	7 (0)	100
Premolar				
8 mm	4 (0)	1 (0)	5 (0)	100
10 mm	6 (1)	8 (0)	14 (1)	93
13 mm	6 (0)	4 (0)	10 (0)	100
16 mm	3 (0)	—	3 (0)	100
Canine				
8 mm	—	—	—	—
10 mm	1 (0)	—	1 (0)	100
13 mm	3 (0)	—	3 (0)	100
16 mm	3 (0)	2 (0)	5 (0)	100
Incisor				
8 mm	—	—	—	—
10 mm	1 (0)	—	1 (0)	100
13 mm	—	—	—	—
16 mm	—	—	—	—
Total	51 (2)	66 (4)	117 (6)	95

was 96%. Survival rates were compared using medical statistics computer software (Sedia, Paris, France). There was no statistically significant difference between these 2 survival rates.

Analysis of Failures

All 6 removed implants (5%) failed before loading; 4 failed in the mandible and 2 in the maxilla. They were all 8- or 10-mm-long implants. Four did not osseointegrate. The fifth implant was stable but presented with 3 exposed threads after 3 months. A 2.5-mm-diameter screwdriver was inserted directly into the internal hexagon of the implant, and reverse torque was applied. Unscrewing of the implant was possible without damaging the connection. A trephine drill was not used. The sixth implant failed for iatrogenic reasons. The patient was about to leave for the holidays; his dentist used a rachet to tighten the healing abutment, and uncontrolled torque was applied to this 8-mm maxillary implant. One month later, reverse torque was applied to remove the healing abutment. The implant started rotating and was lost. No implants were lost after prosthetic treatment was completed.

Crestal Bone Resorption

None of the periapical radiographs were rejected because of poor quality or improper angulation. All films were readable. The Screw-Vent implant has a longer smooth neck (2.5 mm) than standard external-hex implants, but the distance between 2 threads (pitch) is the same (0.6 mm). Rather than measuring the crestal bone resorption in millimeters, it was found more convenient and clinically relevant to indicate at which level (first, second, third, or fourth thread) the CBC could be observed.

Three implants (2.5%) presented with a CBC below the first thread. One of these implants was placed in the mandible and presented a mesial CBC between the first and the second thread and a distal CBC around the third thread. Another implant was placed in the maxilla and presented a mesial CBC between the third and the fourth thread and a distal CBC at the fourth thread. The third implant, also placed in the maxilla, presented a mesial CBC between the third and the fourth thread and a distal CBC above the first thread. No pain, swelling, mobility, nor suppuration were associated with these implants.

Prosthetic Results

All prostheses were functional during the observation period. There was no fracture of implants, abutments, or prosthetic screws. None of the prostheses had to be modified or remade.

DISCUSSION

Several authors have shown good clinical results with wide-diameter implants. In a 1-year prospective study, van Steenberghe and coworkers[19] lost 4.7% of 558 implants that were used in partially edentulous patients. Thirty-six implants had a 4-mm diameter (slightly wider than the standard 3.75-mm diameter). None of these implants failed. In a 5-year follow-up multicenter study,[20] 4-mm-wide implants had achieved better results than standard implants of corresponding lengths. Graves and associates[1] placed and evaluated 268 wide implants (5- and 6-mm) during a 2-year period. They reported a 96% success rate. No information was presented regarding crestal bone loss or patients lost to follow-up. As in the present study, no implant failed after loading. Davarpanah and colleagues[6] studied 56 wide implants (5 mm). Forty-three implants were loaded for more than 18 months and 48 were loaded for more than 1 year at the time of evaluation. They reported a 96% success rate. Bahat and Handelsman[8] compared 5-mm-wide implants with double implants in the posterior region. They used 133 wide implants. The overall failure rate of these 5-mm-wide implants was 2.3% for a mean loading period of 16 months (range 3 to 26 months). No information was presented regarding patients lost to follow-up or crestal bone loss.

Several authors have shown less favorable results with wide-diameter implants. Langer and colleagues[2] were among the first clinicians to use 5- and 5.5-mm-diameter implants. A multicenter study was initiated, and relatively poor success rates (75% to 87%) were quoted by these authors.[9] Barrachina and associates,[11] in a 4-year study, placed 320 wide implants (5 mm) in 179 patients. They reported a survival rate of 86% in the maxilla and 93% in the mandible (89% overall survival rate). Of the total number of failures, 21% occurred after loading. No information was reported on crestal bone loss. Ivanoff and coworkers,[13] in a 3- to 5-year retrospective study, compared the results of implants with different diameters. They observed the highest failure rate (18%) with 5-mm implants. A relationship between implant diameter and implant failure was found. All failures of wide implants occurred at the time of abutment connection or during the first 2 years after loading. Renouard and associates[14] placed 98 wide implants (5 mm) without a smooth collar. Ten implants were lost to follow-up. They reported a survival rate of 92% after 1 year of loading. One fourth of the failures occurred after loading.

It is interesting to note that these authors[2,11,13,14] were using first-generation wide-diameter Brånemark System implants (Nobel Biocare). In 1996, this design was modified significantly (use of standard thread geometry, wider external hex, wider neck, and creation of a smooth collar).[21] In a 6-year retrospective analysis, Minsk and colleagues[12] compared 1,263 implants of 3.25- and 3.75-mm-diameter with wider 5- or 6-mm implants of the same length. Wider implants had higher failure rates.

With a 95% survival rate, the present study shows that favorable short-term clinical results can be obtained with 4.7-mm-wide implants. Implant losses occurred only before loading. Lost implants were easily replaced. These results are in accordance with the short-term clinical results usually reported for standard screw-type implants used in the treatment of partial edentulism.[19,20,22]

Crestal bone loss is an important parameter. For standard screw-type implants, it has been shown that, after an initial period of bone remodeling, resorption usually stops or is drastically slowed down at the first thread.[23] In their study of first-generation wide-diameter Brånemark System implants, Davarpanah and associates[6] reported crestal bone loss beyond the first thread (11%). These lesions were present at or soon after stage II surgery, and no changes occurred during a subsequent 12-month period. Renouard and coworkers[14] also reported on first-generation Brånemark System wide implants. At the 1-year recall appointment, bone loss was assessed radiographically. The number of implants with exposed threads was important (40%). The authors speculated that the elevated peripheral speed of the drill may have caused considerable trauma, especially in dense bone.

The first-generation wide Brånemark System implants used in these studies[6,14] did not have a smooth collar. Threads extended to the implant/abutment connection, and any crestal bone remodeling would expose threads. The 2 manufacturers (Nobel Biocare and Implant Innovations, West Palm Beach, FL) that first introduced wide screw-type implants without smooth collars have subsequently modified the design of their implants.

In the present study, only 3 implants (2.5%) presented crestal bone loss beyond the first thread at the end of the observation period. This may be related to the design of the wide Screw-Vent implant, which features a 2.5-mm-long collar that

allows initial bone remodeling without exposed threads. Because it is associated with a perfectly flat surgical cover screw, the 2.5-mm smooth neck was not found to be too long.

Handelsman[5] considered second-generation Nobel Biocare 5-mm implants to be unsuitable for the premolar area. In the present study, the rate of wide implant placement in premolar sites was 27.3%. In fact, they were placed in all parts of the mouth, except at the mandibular incisors and maxillary lateral incisors (Table 3). With a 4.7-mm body diameter (only 0.3 mm narrower than most other wide implants) and a 4.5-mm neck diameter, the wide Screw-Vent implant seems to be an interesting compromise. It allows patients to benefit from the mechanical advantages of wide implants in premolar sites and, in general, in a wide range of clinical situations.

CONCLUSIONS

This study showed that high survival rates can be obtained after prosthetic treatment with 4.7-mm-wide Screw-Vent implants in a variety of clinical situations. After a mean loading period of 17 months, the overall implant survival rate was 95%. Survival rates in the mandible (94%) and in the maxilla (96%) did not show a statistically significant difference. All failures occurred before definitive prosthesis placement, and lost implants were successfully replaced. None of the prostheses had to be modified or remade. There were no implant, abutment, or prosthetic screw fractures. Of the 117 implants evaluated, only a small percentage (2.5%) presented crestal bone loss beyond the first thread. Long-term prospective studies are needed to confirm these results.

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