Flapless Implant Surgery: A 10-year Clinical Retrospective Analysis

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Purpose: *This article is a retrospective clinical analysis of implants placed with a flapless approach.* ***Materials and Methods:*** *Seven hundred seventy implants were placed in 359 patients to restore both completely edentulous and partially edentulous arches with fixed prostheses or removable complete dentures. Each patient was examined after 3 months, 6 months, 1 year, and then once every year. Prostheses were removed, if possible, and implant mobility was assessed, periapical radiographs were obtained, and periodontal probing was performed. Implants were considered failed if they had mobility or pain, had to be removed, or if they showed more than 0.5 mm of bone loss per year and signs of active peri-implantitis.* ***Results:*** *The cumulative success rate for implants placed using a flapless 1-stage surgical technique after a 10-year period varied from 74.1% for implants placed in 1990 to 100% at 2000.* ***Discussion:*** *Since flapless implant placement is a generally "blind" surgical technique, care must be taken when placing implants. Angulation of the implants affected by drilling is critcal to avoid perforation of the cortical plates, both lingual or buccal, especially on the lingual in the mandibular molar area and the anterior maxilla. There should be no problem if the patient has been appropriately selected and an appropriate width of bone is available for implant placement. There is a learning curve to every surgical procedure, after which it becomes routine. There are many advantages for the patient as well as for the surgeon, since the procedure is less time consuming, bleeding is minimal, implant placement is expedited, and there is no need to place and remove sutures.* ***Conclusion:*** *Flapless implant surgery is a predictable procedure if patient selection and surgical technique are appropriate.* (Int J Oral Maxillofac Implants 2002;17:271–276)

Key words: *dental implants, implant surgery, soft tissue flaps*

The surgical placement of dental implants has undergone changes since the beginning of placement of root-form implants. Initially, using the Brånemark protocol, an incision in the mucosa or the mucobuccal fold was made, and then a flap was reflected to expose the underlying bone. The implants were placed and the flap was sutured back in place.[1–3] The rationale for this incision was to keep the incision line away from the implants, thereby possibly preventing infection. In a retrospective study, Scharf and Tarnow[4] demonstrated that there was no difference in the implant success rates when implants were placed with a midcrestal incision; however, they concluded that it was far more advantageous to use a midcrestal incision since the swelling and the postoperative pain were greatly minimized.

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When dental implants are placed after reflecting soft tissue flaps, there generally is some bone resorption. During the initial phase of healing, bone resorption of varying degrees almost always occurs in the crestal area of the alveolar bone.[5] The extent of alveolar height reduction resulting from this resorption is related to the bone thickness at each specific site.[6]

When teeth are present, blood supply to the bone comes from 3 different paths: from the periodontal ligament, from the connective tissue above the periosteum, and from inside the bone. When a tooth is lost, blood supply from the periodontal ligament disappears, so that blood now comes only from soft tissue and bone. Cortical bone is poorly vascularized and has very few blood vessels running through it, in contrast to marrow bone. When soft tissue flaps are reflected for implant placement, blood supply from the soft tissue to the bone (supraperiosteal blood supply) is removed, thus leaving poorly vascularized cortical bone without a part of its vascular supply, prompting bone resorption during the initial healing phase.

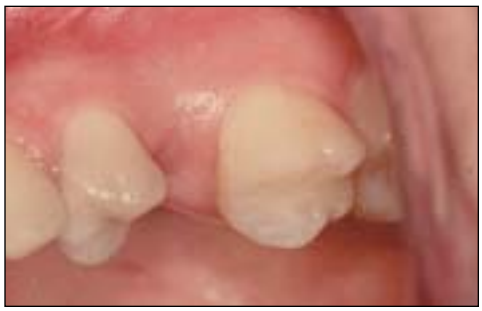


Fig 1a Adequate bone width shown preoperatively.

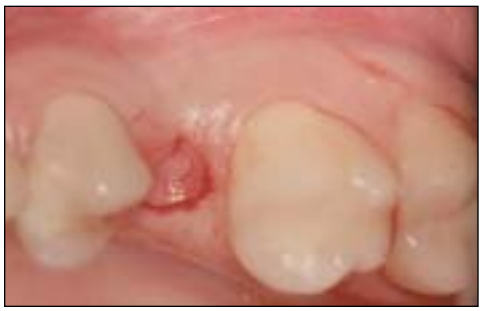


Fig 1b Circular incisions made with the circumferential scalpel at low speed.

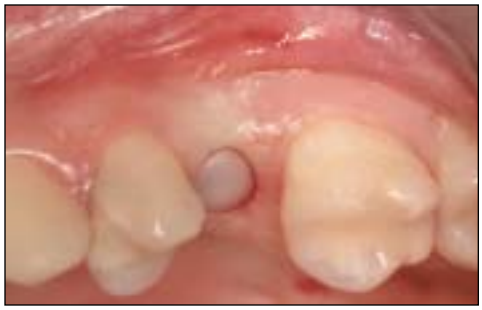


Fig 1c Implant placed with healing cap.

There is some swelling, pain, and discomfort associated with every surgical procedure. With a flapless approach, surgical trauma is minimal because the circular incision is very small, usually 1 mm wider than the implant to be placed, so that postoperative pain, swelling, and discomfort related to soft tissue trauma are greatly minimized.

MATERIALS AND METHODS

In a retrospective clinical analysis dating to 1990, 359 patients were included in the investigation. These patients were provided with a total of 770 implants to replace missing teeth with either fixed partial dentures or implant-retained overdentures. The patient group comprised 126 men and 233 women with an age range from 27 to 83 at implant placement and a mean age of 54.7 years.

Implants used were made of commercially pure grade III titanium with a sandblasted surface and a polished collar of 2 mm. The implants had an external hexagon of 1.7 mm in height. All implants placed were single-stage implants, so no second-stage surgery was performed.

Patient Selection

All consecutive patients who had implants placed to restore either complete edentulism or partial edentulism since 1990 without the use of soft tissue flaps, and who have been followed to date (2000), have been included in this retrospective clinical analysis. Three hundred seventy-seven patients had 860 implants placed with a flapless approach. Patients were followed at 3 months, 6 months, 1 year, and then once every year. Patients who had implants placed with this method and did not attend the yearly follow-up visit were not included in the study for statistical analysis (18 patients, 4.78% drop-out rate), which left a total of 359 patients with 770 implants placed.

Periodontal probing, Gingival Index, and implant mobility were performed by the same clinicians, and implants were considered successful if they met the criteria of Albrektsson and coworkers.[7] Implants were examined at 3 months, 6 months, and then once every year. The restoration was removed, if possible, to check mobility at follow-up visits once a year. Since not all restorations could be removed, the success criteria were not met for every implant; however, they were considered successful if they had no pain while functioning and on percussion. Implants were recorded as failed if they were mobile or painful at any time following treatment, had to be removed because of pain, or showed bone loss of more than 0.5 mm per year for consecutive years after the first year of function. Periodontal probing and periapical radiography were obtained to assess changes in the bone and in peri-implant tissues.

Surgical Technique

Since no soft tissue flaps were going to be raised during implant placement, the quantity and morphology of the bone that would host the implants required preoperative assessment. At least 7 mm of bone width was required for placement using a noninvasive technique with no undercuts, since the direction of the bur would not be visible (Fig 1a). Bone anatomy and quantity were determined by means of a computed tomographic (CT) scan, digital palpation, or calipers. All patients who had

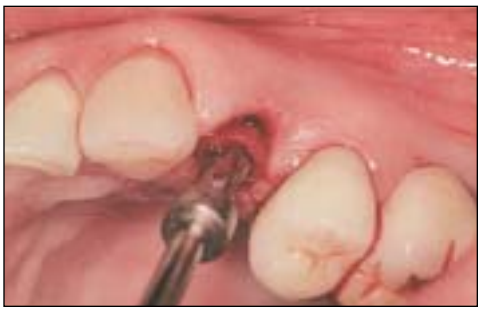


Fig 2a Improper bur angulation may lead to undesired results.

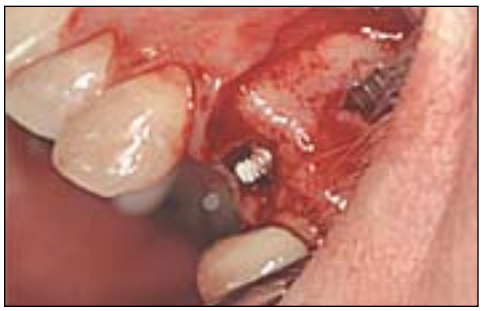


Fig 2b Bone dehiscence after incorrect bur angulation.

implants placed in the maxilla routinely received a CT scan, while the number of mandibular implant patients who received a CT scan varied, depending on the quantity and morphology of the mandible.

Under local anesthesia, a circumferential incision was made in the gingiva at the center of the implant site using a surgical template (Fig 1b). The cut was made with a circumferential rotary blade at low speed (100 rpm). The circumferential scalpel should be at least 1 mm wider than the implant to be placed. The incised gingival tissue was removed with a curette or mosquito hemostat. The thickness of the gingiva covering the bone was measured and the implants were placed as recommended by the manufacturer. Healing abutments were connected to the implants (Fig 1c). With the incision of the circumferential scalpel being 1 mm wider than the size of the implant to be placed, closure of the wound generally occurred between 3 or 4 days.

Fenestration or dehiscence can occur when bur angulation is incorrect, so bur drilling is critical (Figs 2a and 2b). Fenestration occurred with 21 implants (2.73% of total implants placed), 12 in maxillary midsextants, 7 in maxillary left sextants, and 4 in the maxillary right sextant. When fenestration occurred, a soft tissue flap was raised and the fenestration was covered with a xenograft and a resorbable membrane. Dehiscence occurred at 15 implants (2%), 6 in mandibular right sextants and 9 in mandibular midsextants. When dehiscence occurred, if the implant placed was to be used for a removable prosthesis, another implant site was chosen; if the implant's purpose was to support a fixed prosthesis, the site was left to heal for 3 months and then an implant was placed following a traditional soft tissue flap approach.

Since surgical trauma is minimal, anti-inflammatory and analgesic medications were given to the patient as prophylactics and patients were advised not to take them in the absence of pain or swelling. Most patients did not require medication other than antibiotics and pain was minimal.

RESULTS

The cumulative success rate for implants placed using a flapless, 1-stage surgical technique after a 10-year period varied from 74.1% for implants placed in 1990 to 100% in 2000 (Table 1).

Of the 37 failed implants, 37.83% failed between placement and loading, 16.21% failed during the first year of function, and 45.94% failed after the first year of function (Table 1).

Implant location was divided into 6 sextants, which were the maxillary right sextant, maxillary midsextant, maxillary left sextant, mandibular left sextant, mandibular midsextant, and mandibular right sextant (Table 2). The maxillary midsextant was the location that received the fewest implants, with 3.6% of the total; the remainder of the locations were similar in the quantity of implants placed. The cumulative success rate after a 10-year period was over 91% for any of the implant locations (Table 3).

The failures were associated with a learning curve and patient selection, since most of the failures occurred in the early years of using this technique. During 1990, there were 8 failures among 31 implants (25%), which decreased to 0% in 2000 (Table 4 and Fig 3a). The results are associated with the learning curve and patient selection. As the patient selection and technique experience improved, the failure rate decreased, although the number of implants placed increased (Fig 3b).

Every patient who had implants placed without flap reflection was queried. More than 90% of them indicated they had not taken any kind of pain medication and reported the procedure was totally painless. In fact, many patients were referred for treatment because of the reputation of being painless and which, to the patients, seemed simple and effective. Patients with complications during the surgical procedure were given pain medication and treated as if soft tissue flaps were reflected.

Table 1 Number of Implants Placed, Number of Implants Failed and Failing, Time to Failure, and Success Rate for Every Year

Year placed	Implants placed	Failed implants	Failing	Failed + failing	Time to failure* (% of failed implants)	Success rate
1990	31	7	1	8	1: 28.57% (2 implants) 2: 14.28% (1 implant) 3: 57.14% (4 implants)	74.1%
1991	55	6	3	9	1: 66.66% (4 implants) 3: 33.33% (2 implants)	83.6%
1992	62	6	2	8	1: 33.33% (2 implants) 3: 66.66% (4 implants)	87.1%
1993	62	5	0	5	1: 20% (1 implant) 2: 60% (3 implants) 3: 20% (1 implant)	91.93%
1994	68	3	2	5	1: 100% (3 implants)	92.64%
1995	76	3	0	3	3: 100% (3 implants)	96.05%
1996	85	2	3	5	1: 100% (2 implants)	94.1%
1997	73	2	0	2	2: 100% (2 implants)	97.26%
1998	87	2	1	3	3: 100% (2 implants)	96.55%
1999	80	1	0	1	3: 100% (1 implant)	98.75%
2000	91	0	0	0		100%
Total	770	37	12	49		

*1 = between placement and loading; 2 = between loading and 1 year; 3 = after 1 year of function.

Table 2 Situation by Number of Implants

Location	Frequency	Percent	Cumulative percent
Maxillary right sextant	132	17.1	17.1
Maxillary mid sextant	28	3.6	20.8
Maxillary left sextant	122	15.8	36.6
Mandibular left sextant	164	21.3	57.9
Mandibular mid sextant	159	20.6	78.6
Mandibular right sextant	165	21.4	100.0
Total	770	100.0	

Table 3 Implants Failed by Location and Cumulative Success Rate After a 10-year Period

Location	Total implants failed: One implant failure	Total implants failed: Two implant failure	Total	Cumulative success rate (%)
Maxillary right sextant	7	4	11	91.6
Maxillary mid sextant	2	0	2	92.8
Maxillary left sextant	9	0	9	92.6
Mandibular left sextant	4	0	4	97.6
Mandibular mid sextant	8	4	12	92.4
Mandibular right sextant	5	6	11	93.3
Total	35	14	49	

Table 4 Total Number of Failed Implants per Year After a 10-year Period

Valid	Frequency	Percent	Cumulative percent
1990	8	16.32	16.32
1991	9	18.36	34.68
1992	8	16.32	51.00
1993	5	10.20	61.20
1994	5	10.20	71.40
1995	3	6.12	77.52
1996	5	10.20	87.72
1997	2	4.08	91.08
1998	3	6.12	97.92
1999	1	2.04	100.00
2000	0	0.00	100.00
Total	49	100.00	

Fig 3a Total number of failed implants per year after a 10-year period.

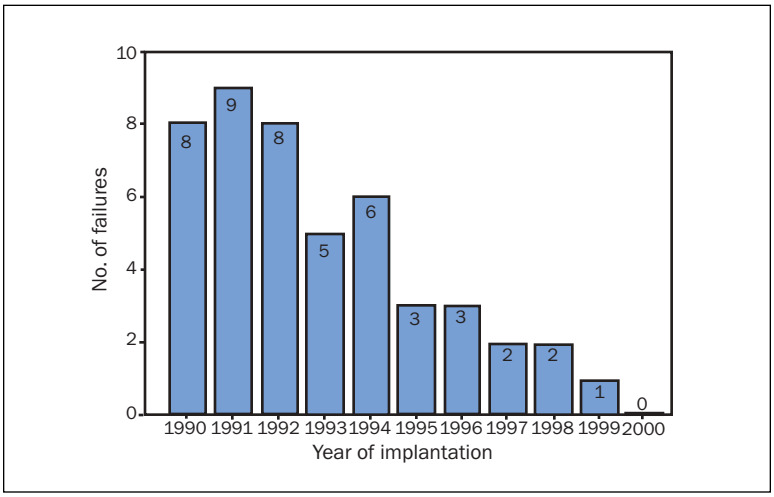
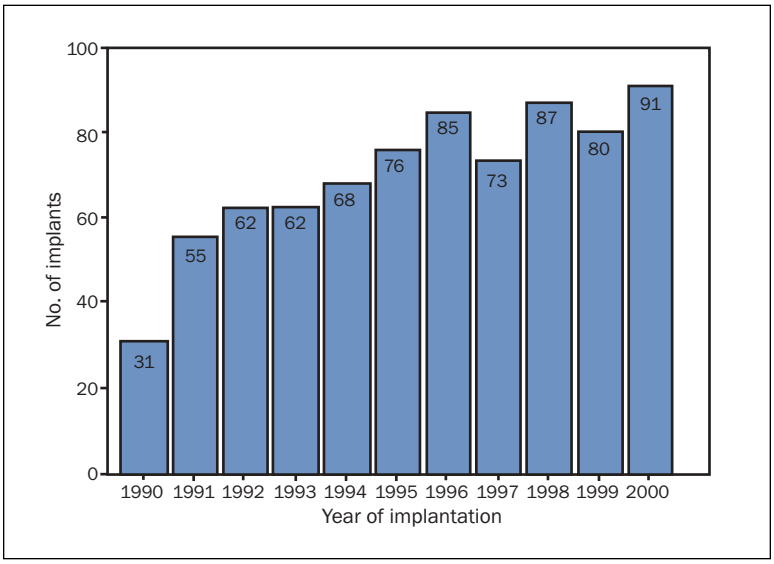


Fig 3b Number of implants per year.



DISCUSSION

Since flapless implant placement generally is a "blind" surgical technique, care must be taken when placing implants. Angulation of the implants affected by drilling is critical so as to avoid perforation of the cortical plates, both lingual and buccal, especially on the lingual in the mandibular molar area and the anterior maxilla. There should be no problem if the patient has been appropriately selected and an appropriate width of bone is available for implant placement.

When the esthetic appearance of the soft tissue is critical, making a flap is far more advantageous, since the soft tissue can be manipulated to place it in a desirable position. Soft tissue augmentation can be predictably achieved around a healing abutment at the time of implant placement or second-stage surgery.

Today, with the use of stone or resin casts obtained from the patients' CT scan and the use of computer software for implant guidance, it is possible to know preoperatively the exact direction of the implants to be placed, making it possible to fabricate surgical templates with guides that precisely orient the direction of the implant burs.[8]

Existing literature concerning the desirability of keratinized tissue around endosseous implants shows conclusive results. While some studies show that the absence of keratinized tissue is not critical to the health of the gingival tissue and implant prognosis,[9,14] other studies suggest that the failure rate is higher when there is an absence or small amount of keratinized tissue.[15–20]

After reviewing this literature, it is apparent that the presence or absence of keratinized tissue depends on the type of implant being used. The absence of keratinized tissue is not critical if machined implants or implants with a polished neck are used, while the presence of keratinized gingiva is critical if rough-surfaced implants (sand blasted, large grit, acid etched, resorbable blast media, acid-etched, etc) are used. Consequently, implant companies have begun bringing the rough surface of their implants down to the second or third thread or providing hybrid designs in which the implants become rougher toward the apical end.

Patient acceptance of this technique has been very high. Patients who have had implants placed with a flapless approach and also the conventional technique clearly prefer a flapless approach. Swelling and pain can be greatly avoided when there is no flap reflection, and patients also realize that there is no need to suture, which makes them believe that surgical trauma is lessened. Most patients, when having implants placed with flapless surgery, require minimal postoperative medication.

There was no occurrence of hematoma compared to the conventional surgical approach, in which it is not rare to observe postoperative hemorrhage. Most patients can return to their normal lives the day following surgery.

There is a learning curve with every surgical procedure, after which it becomes routine. There are many advantages for the patient as well as for the surgeon, since the procedure is less time consuming, bleeding is minimal, implant placement is expedited, and there is no need to place and remove sutures.

CONCLUSIONS

Flapless implant surgery is a predictable procedure when patient selection and surgical technique are appropriate. Correct bur angulation is critical in the procedure, where the chance of fenestration of dehiscence related to incorrect bur angulation must be minimized. As with every technique, there are some advantages and disadvantages associated with flapless surgical implant placement. It is the implant surgeon who should make the decision to place implants using a flapless approach, depending on the quantity and morphology of the bone that will receive the implants and based on his or her own surgical expertise and technique.

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