Retrospective Analysis of Titanium Plate–Retained Prostheses Placed After Total Rhinectomy

Annett Sandner, Dr Med[1]/Marc Bloching, Prof Dr Med[2]

Purpose: *To report the use of a new platelike system (Titanium Epiplating System, Medicon, Tuttlingen, Germany) for rehabilitation of patients after total rhinectomy.* ***Materials and Methods:*** *This retrospective study was conducted on all patients treated between August 2001 and July 2006 with total or subtotal rhinectomy. The clinical outcomes and satisfaction of patients receiving nasal prostheses were evaluated, and the success rate of the subperiosteal implants was determined. Quality of life (QOL) was evaluated with a standardized questionnaire. Patients who had experience with different retention methods responded to a five-point scale evaluating their current satisfaction.* ***Results:*** *Eleven patients (four women and seven men) received nasal prostheses. The mean age was 63 ± 12 years (range, 43 to 84 years). Nine patients were fitted with subperiosteal microplates and followed for a mean of 35 months. Two patients had subtotal rhinectomy and did not receive implants. In four patients immediate implant placement (concurrent with tumor resection) was performed; the other five patients received implants later. The implant success rate was 82%. There was no early implant loss, although one patient lost his implants after 3 years and another patient lost one implant after 1.5 years. QOL scores demonstrated high acceptance of implant fixed retention in comparison with other retention methods (*P = *.001).* ***Conclusions:*** *Implantation of anatomically prefabricated titanium plates has a high success rate in the nasal area, although late implant loss may occur. Patient perceptions of QOL show improvement when prostheses are retained by subperiosteal implants.* Int J Oral Maxillofac Implants 2009;24:118–123

Key words: *platelike systems, prosthetic rehabilitation, quality of life, rhinectomy*

Extended craniofacial defects are considered a severe impairment. Rehabilitation should be completed as quickly as possible, especially in defects resulting from tumor resection.[1] Surgical reconstruction after total rhinectomy is difficult and the esthetic results are not always acceptable.[1–7] For many patients, prosthetic rehabilitation may be the method of choice.[1] And titanium craniofacial implants assure reliable retention of prostheses. Current implant systems are differentiated mainly in terms of shape. The most frequently used include free-standing Brånemark-type implants (Nobel Biocare, Göteborg, Sweden[1,8,9]); zygomatic implants (Nobel Biocare[10]) and platelike systems (such as Epitec, Leibinger, Freiburg, Germany[5]) are also applied. Particularly in the nasal region, positioning of the implants is difficult[3] because of the thinness of the bone. To date, as in the orbital region, success rates are low in the nasal region.[4] Efforts have been made to improve implant success rates by developing new implant designs.

This study reports the results of the prosthetic rehabilitation of patients after total rhinectomy with a platelike system (Titanium Epiplating System, Medicon, Tuttlingen, Germany). Clinical factors affecting the implant success rate were investigated. Quality of life (QOL) with implant-retained nasal prostheses was compared to QOL with prostheses retained via other methods.

[1]Assistant Professor, Department of Otorhinolaryngology, Head and Neck Surgery, Martin Luther University Halle-Wittenberg, Halle/Saale, Germany.
[2]Professor, Helios Klinikum Berlin-Buch, Schwanebecker Chaussee 50, 13125 Berlin, Germany.

Correspondence to: Dr Annett Sandner, Department of Otorhinolaryngology, Head and Neck Surgery, Martin Luther University Halle-Wittenberg, Magdeburger Str. 12, 06097 Halle/Saale, Germany. Fax: +49-345-557-1859.
Email: annett.sandner@medizin.uni-halle.de

Table 1 Patient Characteristics

Patient no.	Gender	Age (y)	Histology	TNM	Surgery	Radiation	Implantation (HBO)	Observation period (mo)
1	M	57	SCC	T4N0M0	TR, DR, PME, BND	70 Gy	Sec (HBO)	67
2	M	65	SCC	T2N0M0	TR, BND	64 Gy	Prim	44
3	F	47	SCC	T4N0M0	TR (rec), PM, LDF	70 Gy	Sec (HBO)	64
4	M	70	BCC	T4N0M0	TR (rec), PM	70 Gy	Sec	62
5	M	43	SCC	T2N0M0	TR	0	Prim	19
6	M	67	BCC	T4N0M0	TR, DR, PM, BND	70 Gy	Prim	23
7	M	51	ACC	T4N0M0	TR (rec), DR	70 Gy	Prim	19
8	M	68	SCC	T4N0M0	TR, UND	54	Sec	15
9	F	73	SCC	T2N0M0	TR	0	Sec	9
10	F	84	SCC	T2N0M0	STR	64 Gy	–	23
11	F	73	SCC	T2N0M0	STR	0	–	34

SCC = Squamous cell carcinoma; BCC = basal cell carcinoma; ACC = adenoid cystic carcinoma; TR = total rhinectomy; STR = subtotal rhinectomy; DR = dural resection/dural plasty; PME = partial maxillectomy; BND = bilateral neck dissection; UND = unilateral neck dissection; LDF = latissimus dorsi flap; Prim = implantation concurrent with tumor resection; Sec = implantation after tumor therapy (operation with/without adjuvant radiotherapy).

MATERIALS AND METHODS

This retrospective study investigated the results of the application of a platelike system (Titanium Epiplating System), which was introduced to patients in 2001. Based on an analysis of recordings in the Martin Luther University clinical information system, patients who had been treated with total or subtotal rhinectomy in the department between August 2001 and July 2006 were sought. The medical records of all identified patients were analyzed retrospectively. The material was reviewed concerning patient aspects, surgical therapy, previous radiation therapy, and hyperbaric oxygen (HBO) therapy (Table 1). Treatment modality data were obtained from the patient records. Data concerning QOL and satisfaction of patients with their prostheses were obtained via patient interviews.

Surgical Procedure and Prosthetics

The implants were inserted into the bone surrounding the area of the craniofacial defect. If possible, two plates (one cranial, at glabella or the anterior wall of the frontal sinus, and one lateral, at the anterior wall of the maxillary sinus) were inserted (Fig 1). The plates were fixed with three bone screws (4.0 or 5.5 mm) and covered with a periosteal flap. Patients were treated with a one-stage surgical procedure since the ends of the plates protruded into the defect in the nasal region. The skin and mucosa were sutured, and Fucidine gauze was wrapped around the exposed portions of the plates for 2 weeks. A stress-free healing period of 3 months was employed for patients who had no previous radiotherapy. If implantation occurred simultaneous with tumor resection and postoperative radiation was performed, the stress-free healing period was also 3 months. For previously irradiated patients, the healing period was 6 months.

Fabrication of implant-retained nasal prostheses started after the healing period. Retention of the nasal prosthesis was obtained with magnets secured to the ends of the plates (Figs 1f and 2).

Home care instructions with regard to the tissue surrounding the plate and maintenance of the prostheses consisted of mechanical cleaning and irrigation with 3% hydrogen peroxide twice daily and cleaning of the prosthesis with water and soap. If possible, thorough cleaning of the defect cavity was performed by the home ENT (an ambulatory care otolaryngologist).

Assessment of Treatment Outcome

Clinical data were analyzed retrospectively at follow-up intervals of 1, 2, 3, 6, 9, and 12 months and then on a biannual basis. The variables reviewed included primary disease, complications encountered during surgery and postoperative healing, implant position, peri-implant skin reactions, implant failure, and elapsed time. Time and quantity of any radiation therapy or HBO therapy were obtained from patient records. Peri-implant reaction was recorded according to the following criteria: 0 = no irritation; 1 = slight redness; 2 = red and moist tissue; 3 = granulation and red and moist tissue; 4 = active infection. Implant failure was defined as a loose or partly uncovered implant that required removal. Hygiene of the implants was recorded as good, moderate, or poor. Concerning implant hygiene, the peri-implant region and the defect area were evaluated, and the frequency of intensive cleaning by the home ENT was recorded.

Fig 1 *Subperiosteal implantation of a platelike system in a 51-year-old man with recurrent adenoid cystic carcinoma of the nose and paranasal sinuses (patient no. 7).*

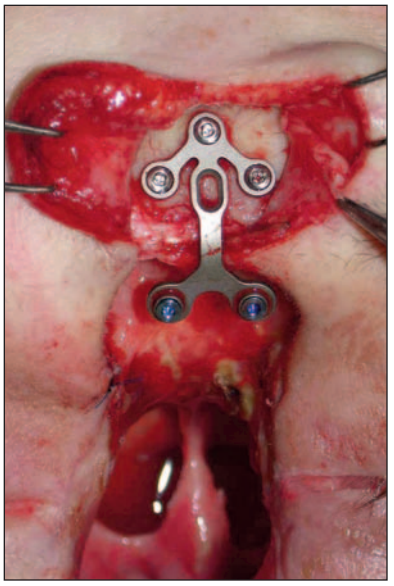


Fig 1a The plate is fixed with three bone screws (4 mm) at the anterior wall of the frontal sinus.

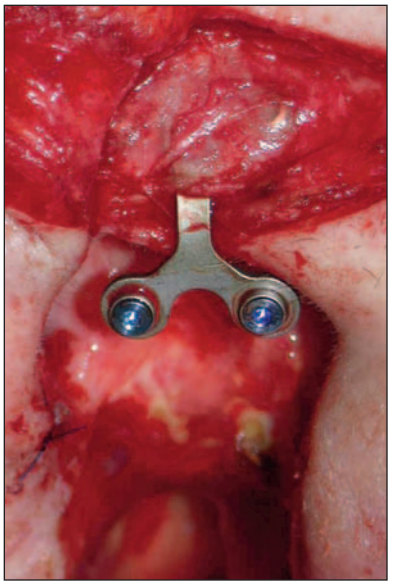


Fig 1b The plate is covered by the periosteal flap from the left side.

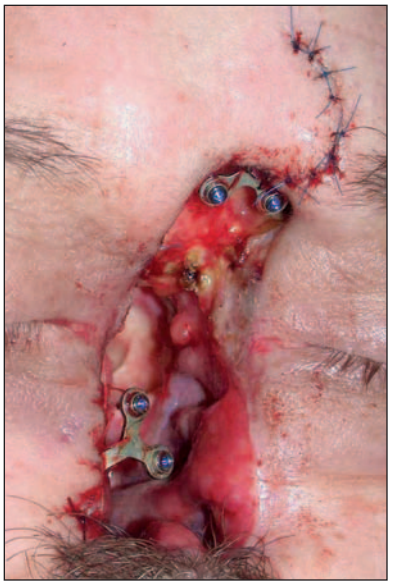


Fig 1c The plates are in situ. The sutures from the skin and periosteal flap do not overlap each other. This ensures undisturbed wound healing.

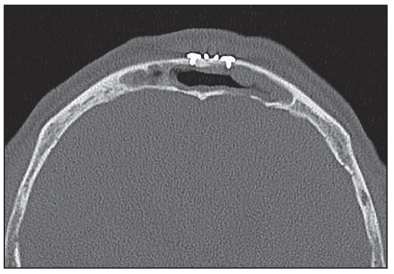
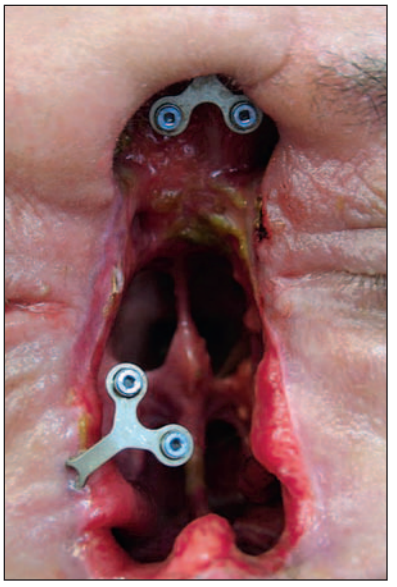
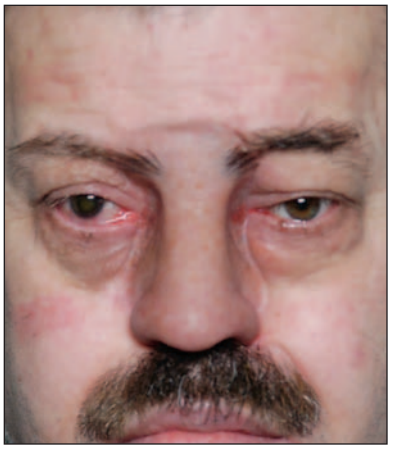


Fig 1d Axial computerized tomographic (CT) scan/bone window at 2 years after insertion showing the cranial plate in situ.

Fig 1e Axial CT scan/bone window at 2 years after insertion showing the lateral plate in situ.





Figs 1f and 1g Patient no. 7 at 6 months postoperatively. The implants are osseointegrated and the nasal prosthesis is in place.

Table 2 Implant Treatment Data with Regard to Irradiation

Irradiation received	No. of implants	Time to loading (mo)	Mean dose (Gy) (SD)	No. of implants lost	Mean follow-up (mo)	Success rate
None	4	3		0	11 ± 5	4/4
Pre	8	6	66 ± 8	3	38 ± 28	5/8
Pre + HBO	4	3	70 ± 0	3	62 ± 2	1/4
Post	5	3	68 ± 3	0	40 ± 19	5/5
Total	17			3	32 ± 23	14/17 (82%)

Pre = prior to implant placement; HBO = hyperbaric oxygen treatment; Post = after implant placement.

Table 3 Distribution of Patient Satisfaction Scores

Satisfaction level	Appearance (n = 11)	Perceptibility (n = 11)	Fit (n = 11)	Fixation (n = 11)	Hold (n = 11)	Self-confidence (n = 11)	Implant care (n = 9)
Very satisfied	10	6	6	8	9	11	5
Satisfied	1	3	3	2	2	0	1
Not satisfied or unsatisfied	0	0	1	1	0	0	2
Poor	0	2	1	0	0	0	1
Very poor	0	0	0	0	0	0	0

Fixation = the simplicity of fixation, ie, implant fixation or glue fixation; Hold = how good is the fixation of the prosthesis through all kinds of activity and under certain circunstances, ie, housekeeping, sports, sweating.

Treatment outcome with regard to patient satisfaction and QOL was assessed using a standardized questionnaire according to Chang et al.[11] All subjects responded to questions regarding esthetics, retention, home care, functional comfort, and psychologic well-being. Patients who had worn prostheses retained by different mechanisms prior to this study were asked to rate these prostheses retrospectively.

RESULTS

Between August 2001 and July 2006, 11 patients (four women and seven men) were treated with total or subtotal rhinectomy for malignancies. Mean age was 63 ± 12 years (range, 43 to 84 years). Nine patients were fitted with subperiosteal microplates. The two remaining patients had subtotal rhinectomy and thus did not receive implants. In all, 17 implants were inserted. Except for patient no. 4 (who received only one plate), all patients received two plates. Mean implantation time was 35 minutes (two plates). In four patients primary implantation (concurrent with tumor resection) was performed, and in five patients implants were placed at a later date. Three patients were treated with radiation therapy after ablative surgery and implant insertion. Four patients were irradiated after tumor surgery but before implant placement. Two of them received adjuvant HBO therapy (20 sessions each).

There were no immediate postoperative complications such as infections or wound dehiscences. In the three patients who received their implants before radiation therapy, no adverse reactions, wound infections, or osteoradionecrosis were observed during radiotherapy.

There were no early implant losses, but three late losses occurred. One patient lost one of two implants after 1.5 years. The remaining cranial implant provided retention of the nasal prosthesis. Three years after insertion, two implants were removed in another patient because of recurrent infections (Table 2). Both patients had received radiation before implantation, with radiation dosage up to 70 Gy. Implant hygiene in these patients was recorded as moderate (patient who lost one implant) or poor (patient who lost both implants).

In five patients, no peri-implant irritation was observed during all examinations. In four patients there was an occasional or recurrent soft tissue reaction. Two patients had temporary grade I or II irritations (red and moist peri-implant tissue). Irritations were successfully treated by intensified local care. In the patients with late implant losses, recurrent infections and granulations occurred.

Fig 2 Patient no. 5: A 43-year-old man with squamous cell carcinoma of the nose. Postoperatively, two osseointegrated bone anchors are in situ and the nasal prosthesis is in place.

Eight of nine patients had magnets for retention of their nasal prostheses. One patient (patient no. 4), who had an extremely extended combined defect of the midface, received a combined magnet/bar clip construction for retention of his facial prostheses. Ten patients had used their implant-retained prostheses for at least 12 months (mean 32 ± 23 months, range 6 to 64 months).

Patient treatment satisfaction data are listed in Table 3. Generally, there was a high degree of satisfaction with the craniofacial prostheses. All patients were content with the appearance of their prosthesis. The fit was evaluated as very good or good in patients with implant-retained prostheses. Five patients appeared to manage implant care very well, two patients achieved moderate care, and two patients showed poor hygiene around their implants.

The four patients who had experiences with different retention methods considered the implant-retained prostheses to be more satisfactory. Assessment of the QOL resulted in a mean score of 9.2 ± 0.7 (range, 7 to 10) for implant-retained prostheses. Previous prostheses were rated from memory, with a mean score of 5.4 ± 2.6 (range, 1 to 9). The difference was highly significant (Pearson chi-square test, $P = .001$), although sample size was too small to warrant more powerful statistical analysis.

DISCUSSION

Like the orbital areas, the nasal region has shown low implant success rates,[8,12] with success ranging between 0% and 81%. Nevertheless, Klein[5] achieved a success rate of 100% at this site with platelike systems. The current study is in line with other evidence in the literature, with a success rate of 82%.

Bone quality and thickness are always critical factors in implant placement. Average thickness of the cortical bone in the forehead/nasal region is 3 mm,[13] often making implant positioning difficult there. The new plates are designed to fit particularly into the defect. The short bone screws are easy to apply, with no need for expensive preoperative or intraoperative three-dimensional imaging.[14] Forces on the abutments are distributed well on the plates.

Implant failure occurred only in patients who had been previously irradiated (70 Gy dose). Implantation into irradiated bone is a particular problem. Several recent studies described decreased implant survival rates when implants were placed in irradiated bones compared with nonirradiated sites.[1,6,15] The extent of radiation damage increases with a higher dosage. Doses below 50 to 55 Gy do not appear to affect osseointegration.[16]

According to the literature, HBO improves implant success rates.[5,16,17] HBO has a positive effect on angiogenesis, bone metabolism, and bone reconstruction.[16] Therefore the two previously strongly irradiated patients (70 Gy) received HBO treatment. Unfortunately, all the lost microplates (n = 3) had been placed in these patients. In these patients, healing time was reduced to 3 months instead of 6 months, in contrast to the two other previously irradiated patients included in the study. This reduced healing period might have contributed to the microplate loss. In addition, one of the patients who lost implants had the worst hygiene scores, and one patient was also a heavy smoker. However, because of the small number of patients, no statistically significant conclusion could be drawn regarding this.

Regardless, accurate and continuous hygiene is

always a major problem in the nasal area. Mucosal secretion causes encrustation of the implants and increases the risk of recurrent infections. The importance of adequate hygiene cannot be stressed enough. Patients need to be given precise instructions on how to clean, and local conditions need to be reviewed frequently.[18] The results of this study have shown that proper peri-implant health (grade 0 or 1) can be achieved if patients follow instructions. Anticipated noncompliance with hygiene instructions is a contraindication for implantation.[19]

Patient acceptance of facial prostheses may be significantly enhanced by the improved retention afforded by craniofacial implants.[11] The advantages for patients wearing implant-retained prostheses are improved retention, ease of positioning, and comfort while wearing. These advantages are reflected in the high level of satisfaction seen in this study. Patients who had experiences with different retention methods described a substantial improvement in QOL with implant-based prostheses. In spite of their disease, some patients were employed full-time. A particularly limited QOL in patients with nasal defects was not confirmed, in contrast to the literature.[20] A limitation of the study is the small number of patients included. Only a multicenter study would provide an adequate number of patients for defect-specific analysis.

CONCLUSIONS

The results of this limited study have shown that, with the platelike system, high implant success rates could be achieved. Implantation time and effort were slight. Irradiated patients are at high risk of chronic infection and implant loss. Adequate hygiene seems to be an important requirement for proper implant health. From the study, it can also be concluded that patient perceptions of quality of life show improvement when prostheses are retained by subperiosteal implants.

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