

Five-Year Success and Failure Assessment of Four Implant Systems

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Abstract:

Aim: In this study a total of 192 implants of four implant systems (Dentium, Dentium Superline, Bego, SGS) placed immediately or delayed in 78 patients were assessed

Materials and Method: Patient's demographics and data on grafts, implant system, size, position, and method of insertion were collected. The follow-up evaluation of the 78 patients was between 2 months to 5 years post-surgery. Clinical parameters (bleeding, pocket depth, or implant mobility) were evaluated during follow up. Clinical comparisons were performed to evaluate implant loss in relation to implant brand, size, position, sex, age, systemic disease, graft, and placement method.

Results: There was no clinical difference with respect to patient's sex or when comparing the different placement methods. A higher failure rate was found for short implants in the anterior region of the maxilla and as age increases. Over a period of 5 years, the overall implant survival rate was 89.9% in the maxilla and 94.2% in the mandible

Conclusion: The average overall survival rate of the implants in general was over 90%.

Keywords: Delayed implant placement, immediate implant placement, long-term investigation

1. INTRODUCTION

Dental implants can be placed immediately after tooth extraction or after extraction and healing of the tooth socket. Immediately placed implants offer several advantages for the patient as well as for the clinician, including shorter treatment time, less bone resorption (before placement), fewer surgical sessions, easier definition of the implant position (via the tooth socket), and perhaps better opportunities for osseointegration because of the healing potential of the fresh extraction site.¹⁻³

A number of animal studies have reported that successful osseointegration is possible when implants are placed immediately after tooth extraction, with or without the help of guided bone regeneration procedures.⁴⁻⁹

The success rate of a 3-year report of immediate and delayed implantation into the extraction socket were similar to those obtained for the placement of an implant into an ossified extraction site according to the standard protocol and were in agreement with other human studies of immediate implant placement, namely over 90%.¹⁰⁻¹⁶ Long-term data for immediate implants are available for up to 5 years.¹⁷⁻¹⁸

The purpose of this study was to evaluate the 5-year success rate of immediate and delayed placement with respect to implant size, system, position, placement methods, grafts, and patient demographics.

2. MATERIALS AND METHODS

A total of 78 patients (54 females and 24 males), were treated with implants at a single center by the primary author immediately (after extraction) or delayed (1 month or more postextraction).

The methods used for implantation were:

1. Implant placed immediately after tooth extraction (immediate placement). No membranes were used.
2. Implant was placed after of one month or more (delayed placement). No membranes were used.
3. Delayed placement plus membranes, TCP, bone grafts, or collagen was used in combination with the above.

One hundred ninety two implants were placed (89 in the maxilla and 103 in the mandible) between February 2011 and February 2016.

Method 1 was used for 48 implants (30 in the maxilla, 18 in the mandible); Method 2 was used for 123 implants (49 in the maxilla, 74 in the mandible);

Method 3 was used was used in 21 implants; 11 in combination with method 1 (5 in the maxilla, 6 in the mandible) and 10 in combination with method 2 (5 in the maxilla, 5 in the mandible).

Patient sex, age, implant system, implant size, site and jaw, method of insertion, graft use and presence of systemic disease were evaluated and the data variables were analyzed as well as clinical parameters (bleeding, pocket depth, implant mobility, implant loss, pain etc) and complications and were evaluated.

The follow-up evaluation was done on 78 patients 2 months to 5 years after surgery. A successful treatment (according to Albrektsson et al 18) was defined as a stable implant without any pathologic findings. Clinical stability, and periapical radiography was used to assess the implants.

Cox regression analysis was used to evaluate the influence of gender, age, implant system, implant location (maxilla or mandible), implant size, placement method and implant failure. When comparing failure rates between methods of insertion, different implant sites, different implant systems, use of grafts and patient gender, the chi-square was used.

3. RESULTS

Implant Loss. Of the 192 implants placed (Table 1), 15 failed (9 in maxilla and 6 in mandible) (Table 2).

Table 1. Number of Implants Placed According to Placement Method Immediate Placement Delayed Placement

	M	M1,3	M2	M2,3
Maxilla	30	5	49	5
Mandible	18	6	74	5
Total	48	11	123	10

Placement methods: 1 = immediate placement; 2 = Delayed placement; 3 = membranes, Tricalcium phosphate (TCP), bone grafts, or TCP collagen used.

Table 2. Implant Loss in Relation to Gender

	Males	Females	Total
Placed	60	132	192
Lost	4 (6.7%)	11	15

Table 3. Implant Losses in Presence of Systemic Disease

Implants	Systemic disease Yes	Systemic disease No	Total
Placed	58	134	192
Lost	8 (13%)	7 (5.2%)	15

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Table4. *Implant Loss in Relation to Grafts Used*

	Grafts Yes	Grafts No	
Placed	21	171	192 Total
Lost	0	15(8.8%)	15 Total

Implant Loss in Relation to Gender. No significant relationship was found between implant failure and gender($p>.05$)(Table2)

Implant Loss in Relation to Grafts. None of the 21implants with grafts failed (Table4).

Table5. *Implant Lossin Relation to Method of Insertion*

	Immediate	Delayed	Total
Placed	59	133	192
Lost	5(8.5%)	10(7.5%)	15

Table6. *Implant Failures in Relation to Placement position in the Jaw*

	Maxilla		Mandible	
	Anterior	Posterior	Anterior	Posterior
Placed	32	57	8	94
Lost	4(12.5%)	5(8.8%)	0	6(6.4%)

Table7. *Implant Failures Related to Implant System*

	Delayed		Immediate	
	Placed	Failed	Placed	Failed
BEGO	48	6(12.5)	6	0
SGS	53	3(5.6%)	23	0(0%)
Implantium	27	1(3.7)	13	4(31%)
Super Line	5	0(0%)	17	1(5.8%)

Implant Loss in Relation to Placement Method. Of the 15 implants that failed, 5 had been immediately placed (method 1), 10 had been placed after one month or more healing period (method 2).The failure rate between immediate or delayed implant placement was not statically significant ($p>.05$)(Table5)

Implant Loss in Relation to Implant Position. The failure rate for implants placed in anterior maxilla was higher than that for implants in the posterior region (12.5 % versus 8.8 %) (Table 6) but this was not significant. In the mandible, the difference in failure rates was 6.4 % for the posterior versus 0 % for the anterior regions. The posterior region of mandible showed significantly higher success rate ($p<.05$)

Implant Loss in Relation to Implant System. Of the 15 implants that failed, 6 were BEGO (Germany),5were Dentium (Korea) ,3 were SGS (Lithuania) and 1 was Superline (Korea)which was statically significant ($p<.05$)(Table7)

Implant Loss in Relation to Patient Age. Increasing age was associated with a higher risk of implant failure($p<.05$)(Table 8)

Implant Loss in Relation to Implant Size. Decreasing implant length and diameter was associated with high risk of implant failure($p<.05$)(Table 8)

Table8. *Attributes of 192 Patients Applied in the Modeling Process*

Variable Name	Mean±SD
Age	52.65±11.22
Diameter	3.89 ±0.67
Length	10 ±1.07

Table 9. Variables in the Equation

	B	SE	Wald	Df	Sig	Exp(B)
Sex	.366	.196	3.494	1	.062	1.442
Age	.016	.008	4.118	1	.042	1.016
SGS			87.346	3	.000	
BEGO	1.048	.826	51.832	1	.000	2.851
IMPLANTIUM	1.001	.370	11.979	1	.001	2.721
SUPERLINE	1.216	.359	11.457	1	.001	.296
Diameter	-.359	.157	5.225	1	.022	.698
Length	-.184	.089	4.280	1	.039	.832
Anterior maxilla			6.939	3	.074	
Posterior maxilla	-.060	.241	.062	1	.803	.942
Anterior mandible	.163	.192	.723	1	.395	1.177
Posterior mandible	-.959	.417	5.305	1	.021	.383
Method of insertion	-.343	.202	2.880	1	.090	.710
graft	-.599	.267	5.037	1	.025	.549

No relationship ($P > .05$) was found between implant failures and gender or for method of placement. But there was a significant relation between implant failure and implant length, diameter, site, use of graft and patient age. ($P < .05$) (Table 9)

Table 10. The Frequency Table of Success and Failure During a 5 Year Period

Status	Frequency	Percent
Success	177	92.2
Failure	15	7.8
Total	192	100

Complications. As previously described, 15/192 implants were lost. Mobility was seen in 1 patient, thread exposure was reported in 2 patients. pain was also documented for 1 patient. There was no significant difference in complications between the different placement methods.

4. DISCUSSION

Placing an implant into a fresh extraction socket seems to offer many advantages for the patient and for the clinician (e. g., shorter treatment time and fewer surgical sessions).¹⁻³

The first 6 months post-extraction are critical because the highest rate of bone resorption occurs during this period.¹⁹⁻²² Therefore, immediate or delayed insertion after extraction can be a realistic opportunity to reduce post-extraction bone loss. This method is an important modification of the older surgical protocol, recommending a 12- month healing period between tooth extraction and placement of implants,²³ and, in our opinion, is especially indicated in the esthetic regions of the jaws.

A cumulative survival rate of 89.9% for the maxilla and 94.2 % for the mandible is similar to survival rates described in other studies that examined delayed or immediate implantation methods.^{10,18} The anatomic characteristics of the extraction socket after tooth extraction varies, after 1 year of healing. Implants placed immediately into fresh extraction sites engage prepared bony walls only at their apex, whereas the coronal space is filled by the end of the healing phase of osseointegration. This is why most of the studies focus on this interval to define survival rates.²⁴

There are few human studies with more than 50 immediately placed screw-type titanium implants published^{12,14,17,25-27} but they all show a high rate of survival, ranging between 93.9% and 100%.

However, sometimes it is very difficult to obtain good primary stability in a fresh extraction socket in the posterior maxilla with short and narrow implants, or implants with wider diameters could perhaps have better prognoses.

Comparing the results of the different methods used in this study, there was no difference, regardless of whether an implant was placed immediately after tooth extraction or after allowing several months of soft and hard tissue healing, if no membranes were used. These results correspond well with the results published by others such as Mensdorff-Pouilly et al.²⁸

The presence of voids or gaps between implant and bone seems crucial.^{29,30,31} and this fact could be the reason for an increased risk of poor osseointegration.

Regarding the importance of gap-filling materials, the impression obtained from the literature is that autologous bone grafts seem to be gold standard and the best filler material,^{25,32} but implants placed into fresh extraction sites without augmentation or grafting also had excellent long-term results.²⁷ The need for bone augmentation and also for primary flap closure has yet to be proven.³³ Although growth factors such as IGF-1, and rhop- I have been tested as bone formation promoters in fresh extraction sites, the results are still questionable.^{34,35}

Histological studies in dogs did not show better bone-implant contact ratios with membranes.³⁶ On the contrary, several studies have shown that membrane exposure led to complications,^{12,14,17} such as bone resorption or failure of the implant.³⁷

Therefore, within the limits of this study, we can conclude that the simplest method of placing implants into fresh extraction sites, may be recommended as we have obtained a high survival rate and implant with bioactive coating (i.e. SGS) can increase implant survival rates.

5. CONCLUSION

This study demonstrated that implants placed according to an immediate or delayed method can be successful for at least 5 years. The success rate of 89.9 % for the maxilla and 94.2 % for the mandible is comparable with the outcomes of other studies. The risk factor of failures in this study are similar to those described in other studies, i.e, short implants, soft bone ,systemic diseases, maxillary and anterior sites etc.)

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