

WHICH FACTORS ARE ASSOCIATED WITH NON-SURVIVAL OF IMPLANTS?

A multicenter retrospective study on 194 explants



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OBJECTIVES

Peri-implantitis represents a comparatively new dental disease with rapidly increasing prevalence. If left untreated or recognized too late, it finally leads to implant loss. To this day, many factors were described to correlate with peri-implantitis and non-survival of implants, yet there were no conclusive studies on the actual amount of bone loss and time of extraction of affected implants in German dental practices conducted.

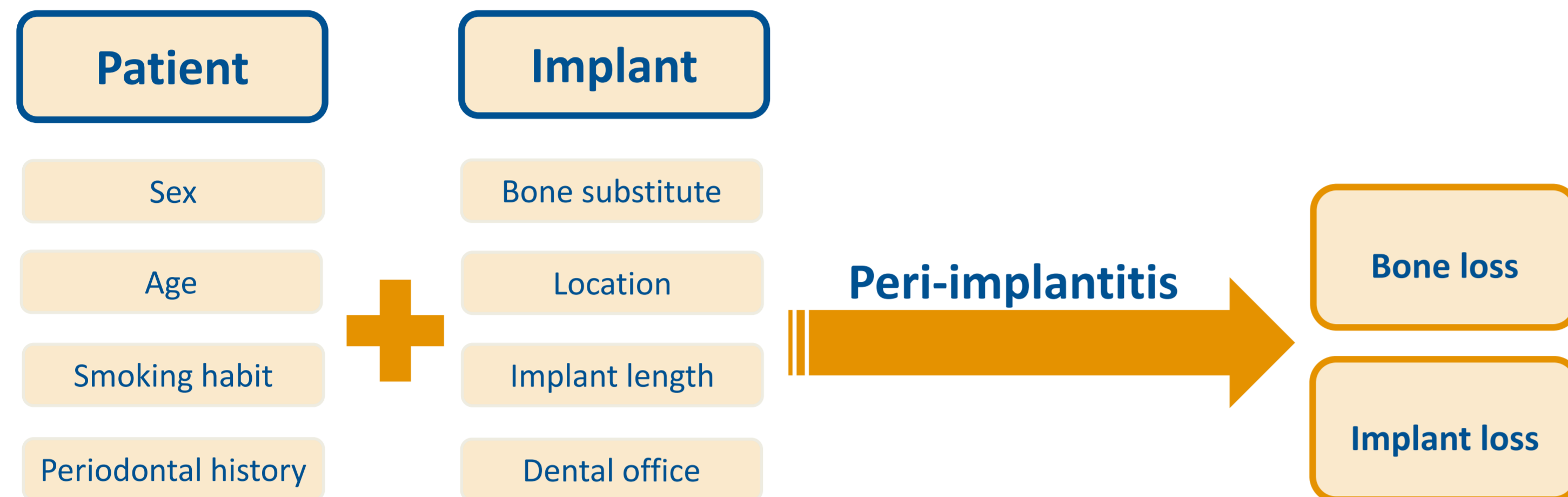


Figure 1: Simplified model how multiple factors influence implant survival.

METHODS

- Study sample:** 12 offices; 161 patients; 194 explants; 100 radiographs
- Classification:** Early loss: implant survival <12 months
Late loss: implant survival ≥12 months
- Statistical Methods:** Missing data replacement by multiple imputation (mice), Chi²-, Kruskal-Wallis-tests, covariate-adjusted multilevel linear regression, graphical modelling
- Level variables:** dental office, patient, implant
- Covariates:** Sex, age, smoking habit, jaw, anterior and posterior implant location, implant length, bone substitute, relative bone loss, survival time
- Outcome variables:** relative bone loss, survival time

Table 1: Characteristics of examined implants.

	n	Total Sample (n=194)	n	Late loss (n=161)	n	Early loss (n=33)	p
Sex							0.185
Male	87	(44.9)	68	(42.2)	19	(57.6)	
Female	101	(52.1)	87	(53.4)	14	(42.4)	
Unknown	6	(3.1)	6	(3.7)	0	(0.0)	
Age at impl. [years]	146	53.2 ± 12.0	116	53.0 ± 11.8	30	53.9 ± 13.1	0.944
Smoking							0.041
No	121	(62.4)	94	(58.4)	27	(81.8)	
Yes	48	(24.7)	44	(27.3)	4	(12.1)	
Unknown	25	(12.9)	23	(14.3)	2	(6.1)	
Jaw							0.522
Upper jaw	95	(49.0)	79	(49.1)	16	(48.5)	
Lower jaw	89	(45.9)	75	(46.6)	14	(42.4)	
Unknown	10	(5.2)	7	(4.4)	3	(9.1)	
Location							0.339
Anterior	50	(25.8)	44	(27.3)	6	(18.2)	
Posterior	134	(69.1)	110	(68.3)	24	(72.7)	
Unknown	10	(5.2)	7	(4.4)	3	(9.1)	
Implant length [mm]	140	10.1 ± 1.8	113	10.3 ± 1.8	27	9.6 ± 1.6	0.127
Bone substitute							0.111
No	101	(52.1)	86	(53.4)	15	(45.4)	
Yes	44	(22.7)	32	(19.9)	12	(36.4)	
Unknown	49	(25.3)	43	(26.7)	6	(18.2)	
Relative boneloss [%]	77	66.2 ± 25.8	68	63.9 ± 25.1	9	83.4 ± 25.9	0.034
Survival time [years]	175	7.9 ± 6.5	142	9.6 ± 5.9	33	0.4 ± 0.3	<0.001

Data are presented as mean (± standard deviation) or number (percentage).

Definitions:
Location anterior: incisors and canini
Location posterior: premolars and molars
P-values for difference between late loss and early loss were obtained by Chi²- and Kruskal-Wallis-tests.

RESULTS

In unadjusted analyses, survival time was significantly associated with age at implantation, usage of a bone substitute and the implanting office (p<0.05). However, in multilevel analyses with full adjustment, only age at implantation remained significant. Regarding relative bone loss, a significant association with the jaw (upper vs. lower) was observed in unadjusted analysis. It was consistent in fully adjusted multilevel analysis, which also showed an association with implant length.

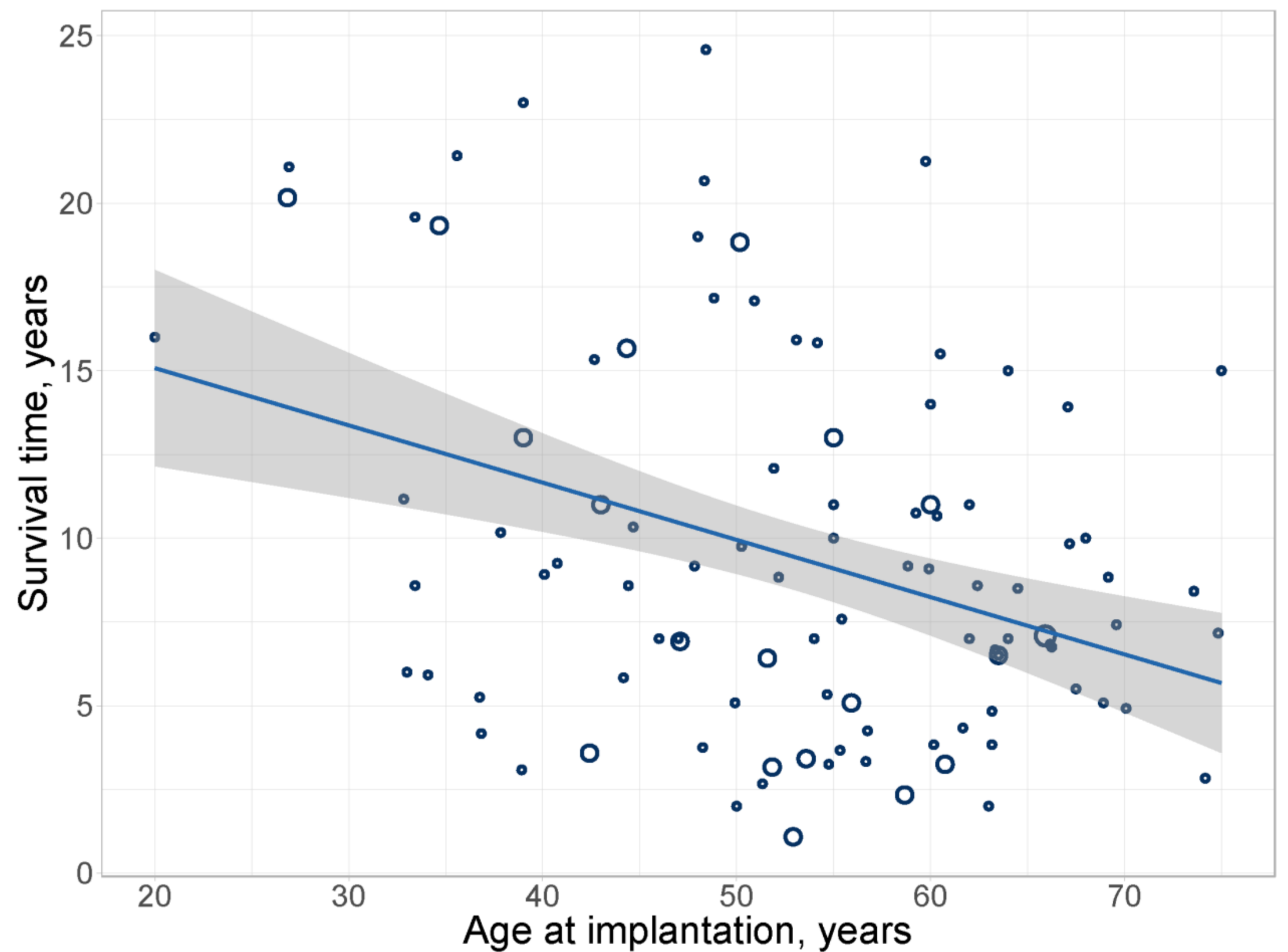


Figure 2: Association between age at implantation and survival time (circle sizes represent number of implants clustered within one patient).

Table 2a: Coefficients from multilevel analysis evaluating survival time.

	Beta coefficient	95% confidence interval	P-value
Age at implantation [years]	-2.30	(-3.35 ; -1.26)	<0.001
Sex, male	-5.39	(-29.46 ; 18.69)	0.661
Smoking, yes	-23.39	(-52.36 ; 5.58)	0.114
Jaw, lower jaw	-8.74	(-28.30 ; 10.82)	0.381
Location, posterior	-0.26	(-7.17 ; 7.12)	0.995
Implant length [mm]	0.36	(-2.89 ; 3.60)	0.829
Bone substitute, yes	-0.80	(-11.77 ; 10.17)	0.886
Relative boneloss [%]	-0.06	(-0.31 ; 0.20)	0.654

Table 2b: Coefficients from multilevel analysis evaluating relative boneloss.

	Beta coefficient	95% confidence interval	P-value
Survival time [months]	-0.03	(-0.12 ; 0.05)	0.487
Age at implantation [years]	0.11	(-0.37 ; 0.59)	0.647
Sex, male	3.91	(-16.02 ; 23.83)	0.701
Smoking, yes	-1.12	(-18.71 ; 16.47)	0.901
Jaw, lower jaw	15.76	(4.00 ; 27.52)	0.009
Location, posterior	-14.19	(-38.36 ; 9.98)	0.132
Implant length [mm]	-2.98	(-5.64 ; -0.32)	0.028
Bone substitute, yes	-0.33	(-21.90 ; 21.22)	0.975

Results were obtained by fully adjusted multilevel (office, patient, implant) linear regression analysis. Missing data was replaced with multiple imputation by chained equation (mice). The beta coefficient is given as months (scaling unit).

CONCLUSION

In this study a mean bone loss of 66.2% at explantation was observed. The unadjusted findings were largely consistent with the literature. It is noticeable that the office (amongst others personal experience, treatment method, choice of implant brand and bone replacement material) and the age of the patient showed the highest impact on survival time in this data.

The jaw demonstrated a prominent association with relative bone loss, which might derive from different bone densities in the upper and lower jaw. Moreover, an association between implant length and relative bone loss was observed, which appears quite natural given the fact that the longer the implant the more absolute bone loss is needed to achieve a given relative amount.