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Risk factors associated with post-loading implant loss of removable and fixed implant-supported prostheses in edentulous jaws

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ABSTRACT

Purpose: This study analyzed risk factors for post-loading implant loss in cases of implant-supported prostheses applied to edentulous jaws of Japanese patients.
Methods: In total, 245 dental implant fixtures placed in 54 edentulous jaws of 46 patients performed at Niigata University Hospital were retrospectively analyzed. Kaplan–Meier curves were used to estimate the cumulative survival rate (SR) of implants, and multiple Cox regression analysis was used to identify predictive factors of implant loss. The following risk factors for implant failure were examined: age, sex, survival time, implant length, implant location, smoking habit, bone density, bone augmentation, opposing dentition, loading period, and type of final restoration. The Cochran–Mantel–Haenszel test was used to examine difference in survival curves of the extracted predictors.
Results: Sixteen implants failed during the observation period (SR = 92.8 %). Multiple Cox regression analysis revealed that male sex [hazard ratio (HR) = 16.1; $p = 0.007$] and use of maxillary removable restorations (HR = 12.7; $p < 0.000$) were risk factors for implant failure. Other factors had no significant effect on implant failure. The SR of implants for males (SR = 86.9 %) was significantly lower than that for females (SR = 99.1 %). The SR of implants for maxillary removable restorations (SR = 76.4 %) was significantly lower than for maxillary fixed restorations (SR = 99.1 %) and mandibular fixed restorations (SR = 97.8 %).
Conclusions: Maxillary implants with removable restorations and male sex were risk factors for implant failure among Japanese edentulous patients.

1. Introduction

Brånemark first attempted to treat an edentulous jaw with dental implants and a fixed bridge in 1965, and consequently, a reported excellent result achieved after 15 years of case accumulation [1]. Since this report, the use of dental implants has become a popular treatment option for patients with edentulous jaws worldwide. More recently, new methods of implant surgery for edentulous patients, such as guided surgery, have been developed along with the evolution of computer technology. In addition, newer treatment concepts of the All-on-4 have resulted in tremendous benefits for patients with edentulous jaws in terms of highly functioning prostheses, reduced invasiveness, and high success rates [2].

Nonetheless, the question remains whether such high success rates with these methodologies could be achieved in Japanese patients despite the anatomical and morphological differences in height, volume, quality, and density of the jaw bone and gingival soft tissue from Caucasian populations [3]. Many individuals in the East Asian population have short-headed [4] and square arch form of jawbone [5], which result in anterior-posterior spread of the implant tends to be comparatively small [6]. Considering these points, some disadvantages possibly exist for implant rehabilitation in edentulous jaws of East Asian patients. Therefore, factors influencing survival rate (SR) and prognosis may vary between Caucasian and East Asian populations. Unfortunately, few clinical studies have investigated the outcomes of such implant treatments among Japanese patients to date. Therefore, the aim of this study was to assess the outcomes and identify risk factors for implant failure in edentulous jaws of Japanese patients.

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Table 1
Overview of implant distribution

Variable	No. of implants	No. of lost implants	Cumulative survival rate (%)
Implant status			
Failes	16	–	
Survived	229	–	
Demographic variable			
Age (y)			
< 65	127	10	90.9
≥ 65	118	6	94.8
Sex			
Male	133	15	86.9
Female	112	1	99.1
Smoking habit			
Non-smokers	183	14	91.4
Smokers	62	2	96.8
Anatomical variable			
Jaw			
Maxilla	162	13	91.4
Mandibular	83	3	95.3
Location			
Anterior	126	7	94.4
Posterior	119	9	91.4
Opposing dentition			
Removable full denture	40	6	85.0
Removable partial denture	33	1	97.0
Natura teeth or fixed denture-supported teeth	35	3	91.4
Natura teeth and fixed denture-supported implant	65	1	98.4
Removable over denture implant	15	2	84.0
Fixed denture-supported implant	57	3	94.7
Implant variable			
Length			
< 8 mm	2	0	100
≥ 8 mm	243	16	92.7
Loading			
Immediate (≤ 48 h)	51	1	98.0
Early (≤ 8 weeks)	26	4	81.5
Delayed (> 8 weeks)	168	11	92.9
Ancillary variable			
Bone augmentation			
With	44	0	100
Without	201	16	91.4
Bone density			
< 350 HU	44	1	97.3
≥ 350 HU	201	15	91.8

Variable		No. of implants	No. of lost implants	Cumulative survival rate (%)
Prosthetic variable				
Restorations	No. of implants per patients			
Maxillary fixed		109	1	99.1
	< 4	0	0	–
	≥ 4	109	1	99.1
Maxillary removable		53	12	76.4
	< 4	7	0	100
	≥ 4	46	12	72.7
Mandibullar fixed		45	1	97.8
	< 4	0	0	–
	≥ 4	45	1	97.8
Mandibullar removable		38	2	93.6
	< 4	13	1	90.9
	≥ 4	25	1	96.0

2. Materials and methods

2.1. Study samples

This study protocol was approved by the Ethics Review Board of the Dental Faculty of Niigata University Graduate School of Medical and Dental Sciences (approval no. 27-R19-10-07).

With 1841 implants placed in Niigata University Hospital from April 2006 to March 2013 as the target, the following inclusion criteria were applied in this retrospective study: (1) an implant placed in an edentulous jaw, (2) rough surface implant, (3) at least 2 years of observation period of the implants after loading, (4) follow-up interval of < 1 year and radiographic monitoring at 1-year intervals at our clinic, and (5) Asian race.

The exclusion criteria were as follows: (1) implant loss before osseointegration or placement of a provisional restoration or the first disconnection of the provisional restoration in immediate loading cases and (2) no follow-up data or medical records before April 2015.

The loss of the implant was defined as the removal of implant from the a body. Reasons for each implant removal were examined, which were as follows; (1) implant movement without infection, (2) severe saucerization of bone around implant with infection, and (3) fracture of fixture.

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