

# Predictive factors for premature loss of Martin 2.7 mandibular reconstruction plates

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## Abstract

Mandibular reconstruction with a plate, with or without a vascularised free (bone) flap, is commonly used to treat patients with a segmental mandibular defect. Common complications are loosening of the osteosynthesis screws, malposition, intraoral or extraoral exposure, or infection. To define prognostic factors for premature loss of such plates and improve future planning, we designed a retrospective study of all patients operated on between 2005 and 2011 for reconstruction of a mandibular segmental defect with a reconstruction plate with or without a free vascularised (bone) flap. Prognostic factors collected from medical records were the patient's age, sex, and American Society of Anesthesiologists (ASA) grade; treatment with radiotherapy; whether they had diabetes or smoked; the site of the mandibular defect; whether there was a dental occlusion; the number of screws used on each side, and the use of a free vascularised (bone) flap; and whether the diagnosis was of oral cancer, benign tumour, or trauma. One hundred patients were included, 79 with oral cancer, 19 with benign tumours, and 2 with trauma. In 20 patients the Martin 2.7 reconstruction plate failed. Diabetes and smoking were significant prognostic factors for premature loss of the reconstruction plate with a hazard ratio of 2.95 (95% CI 1.068–8.172),  $p$  value = 0.04, for diabetes, and 2.42 (95% CI 1.006–5.824),  $p$  value = 0.05, for smoking. Smokers and diabetic patients have a higher risk of failure after mandibular reconstruction with a 2.7 reconstruction plate.

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## Introduction

Segmental mandibular defects may develop during the treatment of oral cancer, benign tumours, or trauma. Reconstruction is important because patients with an unreconstructed mandibular defect may develop contraction of the scar, and deformation of the remaining mandible with drooling, insufficient sealing of the lips, and feeding problems. Mandibular reconstruction with a plate, with or without a vascularised

free (bone) flap, is a common treatment. Reported complications with plates are loosening of the osteosynthesis screws, fractures of the plate, and intraoral or extraoral exposure or infection with rates of complications that range from 28% to 39%.<sup>1,2</sup> In the department of Oral Maxillofacial Surgery of the University Medical Centre Utrecht, Martin 2.7 reconstruction plates are used for bridging mandibular defects with or without a vascularised free (bone) flap.

When possible, immediate reconstruction with a free vascularised bone flap or secondary osseous reconstruction are done in a two-stage operation. In several cases the plate remains in place without osseous reconstruction.

The aim of this retrospective study was to define prognostic factors for premature loss of Martin 2.7 reconstruction plates to improve future treatment planning.

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## Patients and methods

### Design

The retrospective study, which was done by one research worker (EEMR), was approved by the Medical Ethics Committee of the University Medical Centre. All patients treated here between 2005 and 2011 with a segmental mandibular defect caused by treatment of oral cancer, benign tumour, or trauma were included. The mandible was reconstructed with a Martin 2.7 reconstruction plate with or without a free vascularised fasciocutaneous flap or free vascularised osseofasciocutaneous flap.

### Methods of measurement

Data were collected from patients' clinical records. Prognostic factors recorded were age and sex; American Society of Anaesthesiologists (ASA) grade; history of radiotherapy, diabetes, or smoking; site of the mandibular defect (true lateral, symphysis region, or combination of both); presence of a dental occlusion (divided into two lateral and one middle segment); number of screws used on each side ( $\leq 2$  or  $\geq 3$ ); treatment; and diagnosis (oral cancer, benign tumour, or trauma).

Success was defined as a reconstruction plate in place with or without osseous reconstruction, or osseous reconstruction without reconstruction plate. A plate-associated complication was defined as the need for any reoperation as a result of loosening of osteosynthesis screws, malposition, intraoral or extraoral exposure of the plate, or infection without exposure. Complications that could be treated without reoperation (such as with antibiotics) with a satisfactory outcome were not scored as complications.

Failure of the plate was defined as no reconstruction plate in place and no osseous reconstruction anywhere within the follow-up period. The period of survival was defined as the time between placement and removal of the plate (months). Final outcome (success or failure) was measured in November 2013.

### Analysis

Baseline characteristics were analysed descriptively. Failure of a plate was examined using Kaplan–Meier survival curves, and differences between strata using the log-rank test. Cox's regression analysis was used to calculate hazard ratios in univariate and multivariate analyses. All statistical analyses were aided by IBM SPSS software (Version 20 for Windows, IBM Corp, Armonk, NY). Probabilities of less than 0.05 were accepted as significant.

## Results

One hundred patients who were operated on between 2005 and 2011 were included, and results given with a minimal

Table 1  
Baseline characteristics ( $n = 100$ ).

Variable	Number
Mean (range) age (years)	61 (19–86)
Sex	
Male	56
Female	44
Indication for reconstruction	
Oral cancer	79
Benign tumour	19
Trauma	2
Postoperative radiotherapy	
Yes	58
No	42
Diabetes	
Yes	13
No	87
Smoking	
Yes	32
No	68
Site of defect	
Lateral	76
Symphysis	15
Combination	9
Occlusion (no of segments)	
0	59
1	8
2	22
3	11
No. of screws	
Both sides $\geq 3$	83
One side $\leq 2$	14
Both sides $\leq 2$	3
Treatment	
Plate alone	72
Plate with FVFF	13
Plate with FVOF	15
ASA grade <sup>a</sup>	
I	35
II	52
III	13

<sup>a</sup> American Society of Anaesthesiologists.

FVFF = free vascularised fasciocutaneous flap; FVOF = free vascularised osteocutaneous flap.

two-year follow up until November 2013. Baseline characteristics are shown in Table 1. Median (range) survival of plates was 13.7 (0.4–90) months.

Results of reconstruction are shown in the flowchart in Fig. 1. Thirty-seven patients developed a plate-associated complication after reconstruction, which comprised infections without exposure ( $n = 28$ ), intraoral or extraoral exposure ( $n = 4$ ), loosening of osteosynthesis screws ( $n = 3$ ), and malposition of the plate ( $n = 2$ ). These 37 complications led to 20 failures of plates. After reoperation (removal of the plate, reconstruction of the bone, or both), 7 defects were corrected, leaving 13 true failures in this group in November 2013. In the initially successful reconstructed group ( $n = 80$ ), 2 patients lost their osseous reconstruction as a result of a new tumour or osteoradionecrosis, which gave a total of 15 patients with complete failure at the endpoint in November 2013.

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