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Comparison of miniplates and biodegradable plates in reconstruction of the mandible with a fibular free flap

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Abstract

Miniplates and reconstruction plates are usually used to fix a fibular free flap, the gold standard in reconstruction of large segmental mandibular defects. Though biodegradable plates are used in orthognathic operations and repair of fractures nowadays, we know of no studies of the use of biodegradable plates in the reconstruction of segmental mandibular defects including a fibular free flap. We retrospectively reviewed 47 patients who had reconstruction of segmental mandibular defects with fibular free flaps during the past 10 years, and recorded clinical data and morbidity. We compared patients who had reconstruction of such defects with fibular free flaps and miniplates ($n = 26$) with those in whom biodegradable plates had been used ($n = 21$). There was no significant difference between miniplates and biodegradable plates with regard to overall complications ($p = 0.45$) and failure of flaps ($p = 0.59$). After confounding factors had been adjusted for with Cox's proportional hazards regression, there was no significant difference in the proportion of patients who developed a complication between the two groups ($p = 0.4$). The type of plate does not seem to affect overall morbidity in reconstruction of the mandible with a fibular free flap.

Keywords: Free fibular flap; Fixation; Mandible; Reconstruction; Biodegradable plate; Miniplate

Introduction

Microvascular free flaps are the gold standard in the reconstruction of segmental mandibular defects,[1,2] and fibular free flaps are particularly common.[3] Because bony flaps require stabilisation to restore the proper anatomical position and function,[2] devices for fixation have an important role.

Historically, numerous fixation devices have been used, including interosseous wire, stainless steel reconstruction plates, and titanium, hollow-screw reconstruction plates.[2,4–6] In 1989, fixation with titanium miniplates was introduced by Hidalgo.[7] Previous studies that compared miniplate with reconstruction plates in mandibular reconstruction with free flaps found no significant differences in plate-related complications or failure of flaps.[3,8] For high-risk patients who require surgical intervention but may not tolerate extended procedures, a simplified plating procedure may be the most logical option.[2] Miniplates and reconstruction plates are therefore commonly used in mandibular reconstruction with free flaps.

Although biodegradable polylactate polymers were introduced more than 40 years ago by Cutwright et al. for stabilisation of fractures,[9] their usefulness has only recently been appreciated. Despite retrospective studies on the use and stability of biodegradable plates for repair of mandibular fractures and orthognathic surgery,[10–13] we could find no recent paper that has assessed the differences between biodegradable plates and miniplates in reconstruction of the mandible

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with fibular free flaps. Our aim therefore was to compare the rates of plate-related complications and failure of flaps associated with these two fixation devices.

Patients and methods

Fifty-two patients were identified as having had a segmental mandibular defect reconstructed with a fibular free flap at the Department of Oral and Maxillofacial Surgery of the Yonsei University Health System, Seoul, Korea between 2003 and 2013. Five of the 52 were excluded because records were incomplete or a reconstruction plate had been used, leaving 47 patients in the study group. The following data were extracted from their medical records: sex; age; diagnosis; history of smoking, alcohol, radiotherapy, or chemotherapy; operating time; size and type of mandibular defect; type of plate and its survival; plate-related complications; duration of follow-up; and postoperative adjuvant treatment. The defects were classified using the system described by Boyd and Mulholland,[6] into H, C, and L-types.

In cases of hemimandibulectomy in which the mandible including the condyle were removed, we used "pre-bent reconstruction plates or templates" for exact location of the neocondyle using a rapid-prototype model of the patient's own skull as described by Antony et al.[14] In cases of segmental mandibulectomy without the condyle, we used the double plate technique described by Marchetti et al.,[15] to maintain the size of the mandibular defect during reconstruction. The used reconstruction plates were then discarded. The choice of whether to use miniplates or biodegradable plates was made by the individual surgeon (all procedures were done by one of two surgeons in the same hospital with the same protocol and same technique for microanastomosis). The study was approved by the hospital's institutional review board.

The first group consisted of 26 patients who had mandibular reconstruction with titanium miniplates (Synthes; Synthes GmbH, Solothurn, Switzerland or Leibinger Stryker, Freiburg, Germany), and the second group consisted of 21 patients who had their reconstruction with self-reinforced poly(L-lactic-CO-D,L-lactide) copolymer biodegradable plates (Biosorb FX, Linvatec Biomaterials, Tampere, Finland) (Figs. 1 and 2).

The overall complication rate is defined as the complication rate associated with failure of the flap, plus osteonecrosis, plus exposure of the plate, plus loosening of the screws, plus fracture of the plate, plus malunion or non-union, plus any other complications. Other complications included wound infection, orocutaneous fistula, and loss of skin paddle. We defined failure of the flap as a free fibular reconstruction that had to be removed.

Each variable was compared using Student's *t* test for normally distributed continuous variables, the Mann–Whitney test for non-normally distributed continuous variables, and the chi square test or Fisher's exact test for nominal variables, as appropriate. Normality was assessed using the Shapiro–Wilk test. The rate of failure and complications are presented as frequencies. The cumulative incidence of failure of the flap and complications was compared using a log-rank test based on duration of follow-up. To exclude the influence of confounding factors, univariate and multivariate Cox's regression was used. Univariate Cox's proportional hazards regression was used to show potential confounders, and a multivariate Cox's proportional hazards regression was used to compare overall risk of complications between groups after adjusting for the significant confounding factors. All statistical analyses were made with the help of PASW Statistics for Windows, version 18.0 (SPSS Inc, Chicago, Ill, USA), and probabilities of less than 0.05 were accepted as significant.

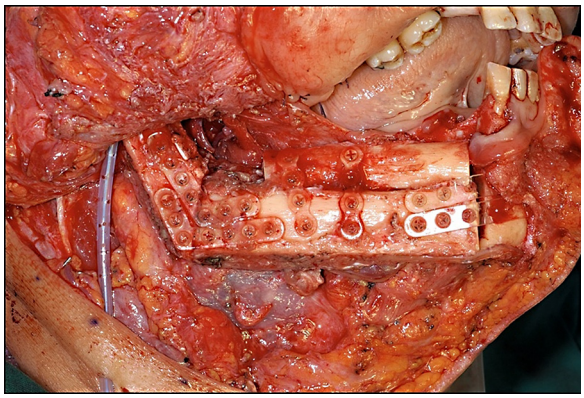

Fig. 1. Operative photograph after harvest and contour of the neomandible.

Fig. 2. Postoperative orthopantograph showing accurate mandibular reconstruction with biodegradable plates and screws.

Results

The characteristics of the two groups are shown in Tables 1–3, and complications as mean (SD) (Table 4). Table 1 lists the diagnoses, and there were no significant differences between them except duration of follow-up time (Table 2). Because of the small number of patients in each group and the large number of categories, data on these variables were categorised as either history or no history. There were no significant differences in the type of defect between the two groups. Time to fixation of the plate was not recorded, but operating times were available. The number of patients who had postoperative adjuvant treatment in the miniplate group was more than