Bone Quality at the Sites of Loosened Screws in Mandibular Reconstruction Plates

Takashi Nuri, MD, PhD
Koichi Ueda, MD, PhD
Masashi Okada, MD, PhD
Yuki Otsuki, MD
Hiroyuki Iwanaga, MD
Department of Plastic and Reconstructive Surgery
Osaka Medical College
Takatsuki, Osaka, Japan

Sir,

Although the osteocutaneous free flap is the best choice for mandibular reconstruction, it cannot be chosen sometimes because of the patient's condition. Then, a metal reconstruction plate is chosen. However, some complications associated are reported.[1–3] Plate exposure is the most common complication. Another complication is dislocation of the plate caused by loosening of the screws. The dislocation may cause plate exposure. We believe loosening of the screws is affected by the quality of mandibular bone. The purpose of this study is to investigate the quality of mandibular bone at the sites of loosened screws. Therefore, we retrospectively studied bone quality at the fixation sites using multidetector row computed tomography images.

We studied a total of 46 fixation screw sites in 6 patients—1 woman and 5 men with a mean age of 70 years (range, 54–78 years)—with cancer. They had been treated with titanium reconstruction plates (Walter Lorenz, Jacksonville, Fla., 2.4 mm locking reconstructive plates) wrapped with rectus abdominis myocutaneous free flaps. They all had undergone multidetector row computed tomography imaging (Aquilion One, 16 and 32; Toshiba). There were a mean of 3.8 (range, 3–6) fixation screws at each location. The mean follow-up was 22.6 months (range, 6–42). Bone quality was assessed by measuring the thickness of the mandible, the thickness of the outer and inner tables of the cortical bone, and the cancellous bone density measured in average computed tomography values (Hounsfield units) in a region of interest that had been shown by pretreatment multidetector row computed tomography to be closely related to hydroxyapatite concentration[4] (Fig. 1). The computed tomography values were accommodated between each unit. All analyses were performed using a software (INTAGE Realia).

A total of 9 screws were loosened at both sides of the plate. Comparative studies were performed on these patients' mandibular bones at sites where loosening did and did not occur. There were significant differences in the thickness of the lateral table of the cortical bone ($P < 0.05$) and in cancellous bone density ($P < 0.05$) at various sites (Table 1). However, no significant differences were recognized in the full thickness and inner table thickness of the mandible.

These results indicate that cancellous bone density affects the stability of the fixation screws and also suggest that the thickness of the outer table of the mandibular bone affects plate stability. In patients with a mandibular reconstruction plate, biting force applied to the mandibular bone is transmitted to the contralateral mandible via the metal plate. When

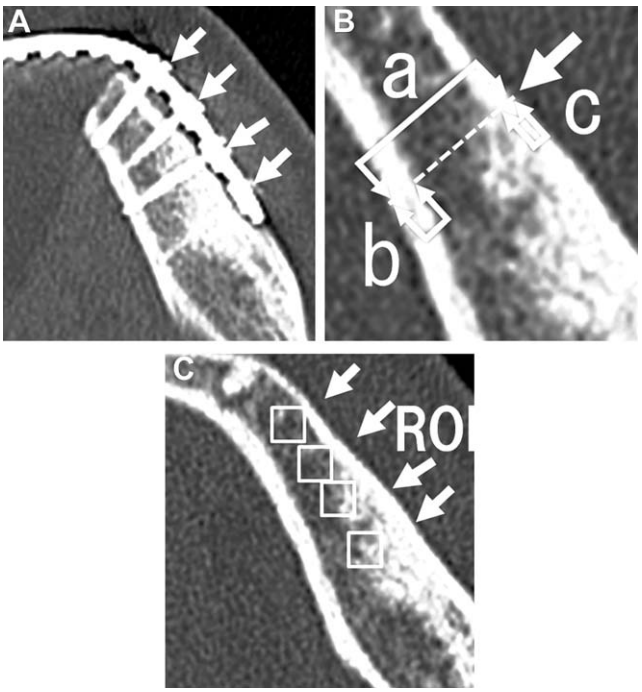

Fig. 1. Preoperative computed tomography of fixation screw sites. A, Sites of 4 fixation screws; B, Thickness of the mandible (a), inner table (b), and outer table (c) of cortical bone; C, Hounsfield units measured in a region of interest.

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Table 1. Results of Comparative Studies of Bone Quality

	Thickness of Mandible (mm)	Thickness of Outer Table of Mandible (mm)	Thickness of Inner Table of Mandible (mm)	Hounsfield Units of the Cancellous Bone of Mandible
Fixed sites (n = 37/46)	11.41	3.34*†	2.38	481.3*†
Loosening sites (n = 9/46)	12.21	1.98*	2.09	271.2*
Male (n = 3/46)	12.49	2.17*	2.44	536
Female (n = 6/46)	12.07	1.88†	1.91	138.8†

*$P < 0.05$, Mann–Whitney U.
†$P < 0.01$, Mann–Whitney U.

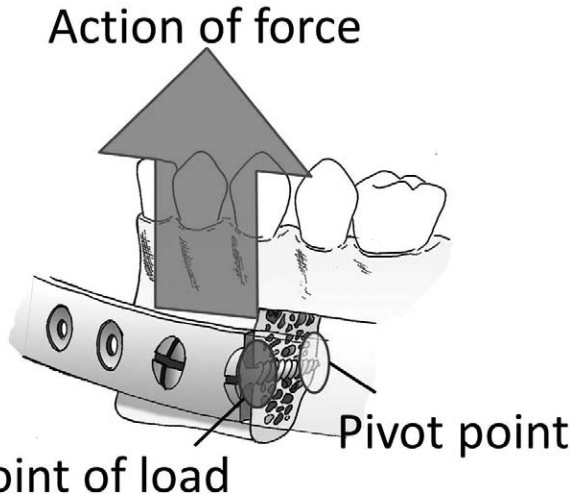

Fig. 2. Application of force on the mandible via a plate. The inner table of the mandibular bone is the pivot point of the force. The mandibular bone outer table is the point of the load.

mechanical energy is considered, the inner table of the mandibular bone becomes a pivot point for the force, and the outer table is the point of loading (Fig. 2). The thickness of the outer table can influence the intensity at the point of loading. Our study suggests that patients with a thin outer table require supplemental fixation.

Correspondence to Koichi Ueda, MD
Department of Plastic and Reconstructive Surgery
Osaka Medical College, Takatsuki
Osaka 569–8686, Japan
E-mail: pla007@poh.osaka-med.ac.jp

DISCLOSURE

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